



October 10, 2011

Mr. Ralph Dollhopf
Region V Emergency Response Branch
United States Environmental Protection Agency
801 Garfield Avenue, No. 229
Traverse City, MI 49686

Subject: Draft Health and Safety Plan
Calumet and Hecla Power Plant Site
Document #: 111440.02

Dear Mr. Dollhopf:

On behalf of Honeywell International Inc., Amec Environment & Infrastructure, Inc. is pleased to submit one hard copy and one CD with an electronic copy of the draft Health and Safety Plan for the Calumet and Hecla Power Plant Site for your review.

If you have any questions please do not hesitate to call Dan Dyer at 248-926-4008 ext. 3026.

Sincerely yours,
AMEC Environment & Infrastructure


Daniel S. Dyer
Project Manager


Garret E. Bondy
Quality Assurance Officer

JDG/sko

Enclosures: Health and Safety Plan

cc: Chuck Geadelmann (Honeywell)

SITE-SPECIFIC HEALTH AND SAFETY PLAN

**LAKE LINDEN – CALUMET AND HECLA POWER PLANT SITE
TORCH LAKE TOWNSHIP, MICHIGAN
HONEYWELL SITE ID. 37156**

Prepared For:

HONEYWELL INTERNATIONAL INC.

OCTOBER 2011

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TORCH LAKE TOWNSHIP, MICHIGAN
HONEYWELL SITE ID. 37156**

Prepared For:

HONEYWELL INTERNATIONAL INC.

Prepared By:

**AMEC ENVIRONMENT & INFRASTRUCTURE, INC.
46850 MAGELLAN DRIVE, SUITE 190
NOVI, MI 48377**

AMEC PROJECT #: 3293111440

OCTOBER 2011

SITE-SPECIFIC HEALTH & SAFETY PLAN (HASP)

for the

Project Name: Lake Linden-Calumet and Hecla (C&H) Power Plant Site
Project Location: M-26, Torch Lake Township, Houghton County, Michigan
Project No.: 3293-11-1440

This HASP, which must be kept on site, addresses the health and safety hazards of each task for this project, including the requirements and procedures for worker protection (per 29 CFR 1910.120 and the AMEC ES&H Program 2.9.A - Hazardous Waste Operations and Emergency Response (HAZWOPER) Program). The Site Health and Safety Officer (SHSO) can change or amend this document only with agreement from the Regional Environmental Safety and Health Manager (RESHM). The SHSO must initial any change made to the HASP at the relevant section and document the amendment date below.

Prepared by: Douglas Saigh AMEC Managing Office: Novi, MI

Approved by:	<u>Douglas Saigh</u>	
	SHSO	Date
	<u>Michael McGowan</u>	
	Construction Manager	Date
	<u>Daniel Dyer</u>	
	Project Manager	Date
	<u>Cynthia Sundquist, CIH, CSP</u>	
	Regional HSE Manager	Date

Amendment(s): _____

All site workers shall read this HASP. A pre-entry briefing conducted by the SHSO shall be held prior to initiating this project. Items to be covered during the briefing can be found on the Site Safety Orientation Form (Appendix A). All applicable sections of this HASP shall be reviewed during this briefing. The SHSO shall review the information covered in the pre-entry briefing meeting with any worker not in attendance at the initial meeting prior to commencing work. Brief meetings will be held at the beginning of each work day to discuss important safety and health issues concerning tasks performed on that day and documented on the Daily Tailgate Safety Meeting Checklist (Appendix B) and the Weekly Site Safety and Health Checklist (Appendix C). After reading the HASP and attending a pre-entry briefing, workers shall sign the following acknowledgment statement:

TABLE OF CONTENTS

1.0	SITE DESCRIPTION AND HISTORY	1
1.1	SITE DESCRIPTION	1
1.2	SITE HISTORY	1
2.0	KEY PERSONNEL AND HEALTH AND SAFETY RESPONSIBILITIES	2
3.0	WORKER TRAINING	4
4.0	MEDICAL SURVEILLANCE	4
4.1	SUBSTANCE ABUSE AND PREVENTION POLICY	4
5.0	SITE CONTROL	5
5.1	WORK ZONES	5
5.2	BUDDY SYSTEM	5
5.3	SITE ACCESS.....	8
5.4	GENERAL SAFE WORK PRACTICES	8
6.0	HAZARD ANALYSIS	8
6.1	CONTAMINANTS OF CONCERN	9
6.2	JOB HAZARD ANALYSIS.....	9
7.0	AIR MONITORING	10
7.1	PERSONAL AIR MONITORING	11
7.2	AMBIENT AIR MONITORING.....	11
8.0	PERSONAL PROTECTIVE EQUIPMENT	12
9.0	DECONTAMINATION	12
10.0	EMERGENCY RESPONSE	14
10.1	HOSPITALS/CLINICS	14

TABLE OF CONTENTS

10.2	EMERGENCY CONTACTS.....	14
10.3	EMERGENCY RESPONSE EQUIPMENT.....	14
10.4	COMMUNICATIONS	19
10.5	EMERGENCY RESPONSE PROCEDURES.....	19
	10.5.1 AMEC Triage Program.....	19
10.6	HONEYWELL SPECIFIC ADVERSE EVENT REPORTING AND LESSONS LEARNED REQUIREMENTS	20
	10.6.1 Tier 1:.....	20
	10.6.2 Tier 2:.....	20
	10.6.3 Tier 3:.....	21
10.7	BLOODBORNE PATHOGENS	21
	10.7.1 Universal Precautions	21
	10.7.2 Decontamination/Laundrying	22
	10.7.3 Vaccines, Evaluation, Follow-Up	22
	10.7.4 AMEC Early Injury Case Management Program	23
11.0	SPILL CONTAINMENT	26
12.0	HAZARD COMMUNICATION	26
13.0	RECORD KEEPING.....	27

LIST OF TABLES

Table		<u>Page</u>
Table 2-1	Key Personnel and Health and Safety Responsibilities.....	3
Table 3-1	Training/Medical Surveillance/Respiratory	6
Table 5-1	General Safe Work Practices.....	7
Table 7-1	Action Levels Per Monitoring Instrument	9
Table 8-1	PPE and Monitoring Requirements Summary.....	11
Table 10-1	Emergency Contacts	16

TABLE OF CONTENTS

Table 10-2	Emergency Procedures	22
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LIST OF FIGURES

Figure

Figure 1-1	Site Location Map.....	26
Figure 1-2	Site Features Map	27
Figure 10-1	Hospital Route Map.....	13
Figure 10-2	Clinic Route Map.....	14
Figure 10-3	Incident Reporting Flow Diagram.....	23

LIST OF APPENDICES

Appendix

APPENDIX A	SITE SAFETY ORIENTATION FORM
APPENDIX B	DAILY TAILGATE SAFETY MEETING CHECKLIST
APPENDIX C	WEEKLY SITE SAFETY AND HEALTH CHECKLIST
APPENDIX D	CONTAMINANT FACT SHEETS
APPENDIX E	JOB HAZARD ANALYSIS PER TASK(S)
APPENDIX F	DECONTAMINATION PROCEDURES & EQUIPMENT PER TASK(S)
APPENDIX G	INCIDENT ANALYSIS FORMS
APPENDIX H	SPILL CONTROL PLAN
APPENDIX I	MATERIAL SAFETY DATA SHEETS
APPENDIX J	SHSO SUMMARY
APPENDIX K	LEAD MEDICAL MONITORING PLAN
APPENDIX L	ASBESTOS MONITORING AND SAMPLING PLAN

1.0 SITE DESCRIPTION AND HISTORY

A brief description of the site and its history are presented below.

1.1 SITE DESCRIPTION

The Site occupies approximately fourteen acres located at 5371 Highway M-26 in Torch Lake Township, Houghton County, Michigan. The property lies on the shoreline of Torch Lake. Formerly, the Site functioned as an industrial complex that housed a number of buildings related to C&H's copper mining operations, including a boiler house, still house, filter house, stamp mill, and the Power Plant building (Figure 2.1). Excluding the Power Plant building, all buildings on the property have been demolished, although remnants (i.e., significant foundations) of those buildings remain. The Power Plant building is in a dilapidated state. The December 7, 2010 Site Assessment (Weston, 2010) describes the building as having holes in the roof, as well as holes in the floor as large as 900 square feet.

During the course of 2010, the United States Environmental Protection Agency (U.S. EPA) undertook a three-phase Site Assessment, which culminated in the 2010 Site Assessment Report (Weston, 2010). The 2010 Site Assessment documents two specific concerns that require immediate remediation: 1) Asbestos Containing Material (ACM) in and around the building; and 2) inorganic metals in soil at the Site. In addition, the 2010 Site Assessment states that the U.S. EPA has detected low concentrations of polychlorinated biphenyls (PCBs) in sediment and water in the flooded basement of the building, and seeks to undertake further investigation to determine whether PCB remediation may be necessary. Drums (some floating, some submerged) with unknown contents were also noted in the basement. Due to these concerns, the 2010 Site Assessment recommends removal of certain onsite soil to the depth of 1 foot where inorganic and ACM materials exist, and ACM remediation in and around the Power Plant building. In addition, the Site Assessment recommends further assessment of the materials contained in the basement (sediment, water, and containers).

1.2 SITE HISTORY

The Site is the former location of a large industrial complex that crushed or “stamped” rock from nearby copper mines. The copper ore was recovered by the stamping process. Stamping operations began at the Site in 1868.

The C&H Power Plant was established in 1905 to meet the electrical demands of the evolving industrial complex and mining operations. The power plant was one of two electrical generating stations that operated in parallel and supplied electricity throughout the region. By 1931, the power plant was connected to the electrical grid through transformers and eight outgoing feeders that exited the west side of the building overhead.

In approximately 1915, C&H began reclaiming stamp sand and constructed two regrinder plants (No. 1 and No. 2), a flotation plant, a leaching plant, and a distillation plant. Most of these facilities reportedly were located on the adjacent property northeast of the Site. C&H operated the Site until 1968, when C&H and Universal Oil Products merged. Shortly after the merger, plant operations were terminated following an employee strike. Thereafter, the Site was sold to Rudolph Kump (date unknown), and Mr. Kump sold the property to Louis Meneguzzo on December 17, 1998 through a quit claim deed. Mr.

Meneguzzo transferred the property to MENINC, Inc. on February 16, 2000, in which he and his wife appear to be the sole officers. MENINC, Inc. is the current owner of the property.

The following tasks are to be performed at the Site. Checked boxes indicate that the task will be performed by AMEC or an AMEC subcontractor adapting AMEC’s HASP. Unchecked boxes indicate that the task will be performed by a subcontractor under their own HASP.

Coleman	Marquette Fence	AMEC	Tasks	Initial Level of PPE
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	▪ Collect geophysical data for utility clearances as needed	C
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	▪ Direct push drilling	C
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	▪ Location and Elevation Survey	C
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	▪ Install site boundary fencing	C
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	▪ Document construction/demolition activities by all construction/demolition contractors	C
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	▪ Perform activity based sampling (ABS)	C
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	▪ Collect air samples before and during construction activities as necessary	C
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	▪ Perform asbestos inspections and collect asbestos air and bulk samples	C
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	▪ Collect soil laboratory samples from drilling samples	C
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	▪ Daily dust monitoring	C
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	▪ Collect waste characterization samples	C

Expected start date: **October 2011**

Expected duration of project: **12 months (approximate)**

Expected average number of workers onsite per day: **2 AMEC employees, 3 subcontractors**

2.0 KEY PERSONNEL AND HEALTH AND SAFETY RESPONSIBILITIES

Table 2.1 describes health and safety responsibilities for key project personnel.

TABLE 2-1

KEY PERSONNEL HEALTH AND SAFETY RESPONSIBILITIES

REGIONAL HEALTH, SAFETY AND ENVIRONMENT MANAGER Cindy Sundquist	FIELD LEAD (FL) Scott Rought	SITE HEALTH & SAFETY OFFICER (SHSO) Douglas Saigh	PROJECT PERSONNEL
<ul style="list-style-type: none"> • Implement appropriate corporate health and safety policies, or environmental projects • Approve HASP and Amendments • Maintain exposure monitoring records • Notify Corporate HSE Manager in the event of an emergency situation • Verify that corrective actions recommended on Incident Analysis Forms have been implemented 	<ul style="list-style-type: none"> • See that personnel receive this plan, are aware of its provisions, and are aware of the potential hazards associated with site operations, are instructed in safe work practices, and are familiar with emergency procedures, and these actions are documented • Determine that appropriate monitoring and personnel protective equipment are available • Monitor the Field Logbooks to ensure the health and safety work practices are employed • Coordinate with SHSO so that emergency response procedures are implemented • Ensure corrective actions recommended on Incident Analysis Forms are implemented 	<ul style="list-style-type: none"> • Implement project HASP; report to the Project Manager for action if any deviations from the anticipated conditions exist; and authorize the cessation of work at site investigations if necessary • Confirm that prior to a hazardous waste site visit, site personnel meet the proper medical requirements and have the health and safety training to qualify them to perform their assigned tasks. Identify all site personnel with special medical conditions. • Conduct pre-entry briefing and tailgate safety meetings. Document meetings on Daily Tailgate Safety Meeting Checklist (See Appendix H) • Verify that all monitoring equipment and personal protective equipment is operating correctly according to manufacturer's instructions and such equipment is utilized by on-site personnel. Calibrate or verify calibration of all monitoring equipment and record results. • Conduct weekly inspections of jobsite using the Weekly Site Safety And Health Checklist (See Appendix I) • Implement site emergency and follow-up procedures 	<ul style="list-style-type: none"> • Be familiar with and abide by the HASP • Notify the SHSO of any special medical conditions (e.g., allergies) • Immediately report any accidents and/or unsafe conditions to the SHSO • No individual shall go on site where he/she does not have the required safety training

3.0 WORKER TRAINING

Upon designation of a specific project team, Table 3.1 will be completed to summarize the training experience of the project team with respect to 29 CFR 1910.120(e), 29 CFR 1910.38, and 29 CFR 1910.1200 and AMEC (former Mactec) ES&H Programs and Procedures: ESH 2.9.A – Hazardous Waste Operations and Emergency Response Program and ESH 2.9.E – Hazard Communication Program.

4.0 MEDICAL SURVEILLANCE

Upon designation of a specific project team, Table 3.1 will be completed to indicate the workers who participate in the company's Medical Surveillance Program (AMEC, former Mactec ESH 2.13.1) [29 CFR 1910.120(f)]. All workers who could potentially be exposed to concentrations of contaminants above the OSHA Permissible Exposure Limits (PELs) for 30 days per year or more must be included in the Medical Surveillance Program. Any site-specific medical surveillance conducted for site workers will also be listed on the table

4.1 SUBSTANCE ABUSE AND PREVENTION POLICY

Contractors performing, and those individuals that provide direct supervision (means and methods) of the following work activities shall comply with Honeywell's Substance Abuse and Prevention Policy:

- The use of heavy, construction-type equipment including, but may not be limited to, excavator, cranes of any type, drilling equipment, including direct push and sonic technologies, compactor, etc.;
- Safety sensitive/at-risk work such as, but may not be limited to, confined space entry, lockout/tagout, dredging operations, hot work activities, etc.;
- Other work activities not listed can be assessed on a case-specific basis by the PM of the Alliance/Non-Alliance Firm and/or the certified safety and health professional approving the HASP for such activity to determine applicability to the policy.

Honeywell prohibits the use, manufacture, sale, possession, or transfer of illegal drugs, alcohol, and controlled substances on any of their sites. See Specification 01620 and contract documents for specific details regarding the requirements of the Substance Abuse and Prevention Policy. As an overview the policy includes the following elements:

- Contractor's drug screening program and reporting shall comply with and be in accordance with Parts 382 and 40 of the Federal Motor Carrier Safety Regulations, Department of Transportation;
- Pre-assignment screening for illegal/unauthorized substances (alcohol, marijuana, cocaine, opiates, amphetamines and phencyclidine) must occur not more than two (2) weeks prior to their initial assignment for work at Honeywell's site. Contractor personnel who are in a continuous random drug testing program are not required to be screened for subsequent work activities at the same site, except for alcohol testing. If contractor does not have a random monthly screen rate of 10 percent, contractor is required to be drug and alcohol screened on a monthly basis for long-term projects (projects greater than 30 days) and be retested each time they begin a work at any site; and,

- In addition, to pre-assignment testing, contractors shall establish procedures in the HASP for post-accident and reasonable suspicion testing for illegal/unauthorized substances.

5.0 SITE CONTROL

Site control procedures, as required by 29 CFR 1910.120(d) and AMEC (former Mactec) ESH 2.9.A - Hazardous Waste Operations and Emergency Response Program, will be implemented before the start of site tasks to control worker exposures to contaminants.

5.1 WORK ZONES

To be determined at the site by the SHSO. At this time it is anticipated that the work zones will be defined relative to the location of the work activity. The Exclusion Zone is considered the area within a 10-foot diameter of the sampling location. The Contamination Reduction Zone is considered to be the area within a 20-foot diameter of the sampling location. The decontamination zone will be located upwind of the work area. Work zones will be maintained through the use of:

- Warning Tape
- Visual Observations

5.2 BUDDY SYSTEM

When required by contract or when conditions exist that could be dangerous to life and health, a buddy system shall be implemented.

- Yes No
- Buddy System required?

TABLE 3-1

TRAINING/MEDICAL SURVEILLANCE/RESPIRATORY PROTECTION RECORDS

	Required?	Names of Key Field Team Members					
		AMEC Dan Dyer	AMEC Mike McGowan	AMEC Douglas Saigh	AMEC Scott Rought	AMEC Joe Gonzales	AMEC Jack Lupo
Training/Medical		Dates	Dates	Dates	Dates	Dates	Dates
Medical Surveillance	Y	NA	NA	12/14/10	08/03/10	12/17/10	08/05/10
Site Specific Medical Testing ¹ : _____	N						
40-Hour Initial	Y	02/23/90	07/28/95	06/01/99	12/02/93	01/10/03	08/02/04
8-Hour Supervisor ³	N	NA	03/21/06	03/21/06	12/02/93		
8-Hour Refresher	Y	04/04/11	04/15/11	05/1/11	02/03/11	04/04/11	04/04/11
First Aid/CPR ^{1,2}	Y	NA - 12/17/10	02/16/09 - 05/12/10	02/16/09 - 05/12/10	02/14/11	02/16/09 - 05/12/10	02/16/09 - 05/12/10
Respirator Fit Test ¹	Y	NA	NA	02/25/11	12/02/09	NA	02/25/11
Respirator Brand ¹	N	NA	NA	MSA GME-P100	MSA Comfort	NA	MSA GME-P100
Hazard Communication ³	Y	NA	04/15/11	06/16/11	12/2/93	3/20/07	04/15/11
Confined Space Entry ¹	N	NA	NA	NA	NA	NA	NA
Fall Protection ¹	N	NA	NA	NA	NA	NA	NA
Client Required ¹	N	NA	NA	NA	NA	NA	NA
Michigan Asbestos Inspector ⁴	Y	NA	NA	01/11/11	11/18/11	NA	05/02/11

¹ If Applicable

² At least one worker must be trained in First Aid/CPR and have received Bloodborne Pathogen training.

³ Required if acting as LF or SSHO

⁴ Required if identifying, quantifying, and/or sampling ACM

NA – Not Applicable

TABLE 3-1 (continued)

TRAINING/MEDICAL SURVEILLANCE/RESPIRATORY PROTECTION RECORDS

	Required?	Names of Key Field Team Members					
		COLEMAN ENGINEERING, INC. Jim Blondheim	COLEMAN ENGINEERING, INC. Darrell Hoskings	COLEMAN ENGINEERING, INC. Art Losey	MARQUETTE FENCE CO. Jeff Allen	MARQUETTE FENCE CO. Ross Manninen	MARQUETTE FENCE CO. Mike Seymour
Training/Medical		Dates	Dates	Dates	Dates	Dates	Dates
Medical Surveillance	Y	09/06/11	09/06/11	01/26/11	In process	In process	In process
Site Specific Medical Testing ¹ : _____	N						
40-Hour Initial	Y	05/03/10	08/14/03	11/26/07	9/30/11	9/23/11	9/23/11
8-Hour Supervisor ³	N	NA	NA	NA	NA	NA	NA
8-Hour Refresher	Y	NA	NA	NA	NA	NA	NA
First Aid/CPR ^{1,2}	Y	04/01/11- 04/01/14	04/01/11- 04/01/14	07/26/11 –07/26/13	NA	NA	NA
Respirator Fit Test ¹	Y	10/03/11	10/03/11	10/03/11	In process	In process	In process
Respirator Brand ¹	N	MSA	MSA	MSA	In process	In process	In process
Hazard Communication ³	Y	02/10/11	02/10/11	In process	NA	NA	NA
Confined Space Entry ¹	N	NA	02/11/11	NA	NA	NA	NA
Fall Protection ¹	N	01/05/11	01/05/11	NA	NA	NA	NA
Client Required ¹	N						

¹ If Applicable

² At least one worker must be trained in First Aid/CPR and have received Bloodborne Pathogen training.

³ Required if acting as LF or SSHO

NA – Not Applicable

COLEMAN – Coleman Engineering Company

MARQUETTE – Marquette Fence Company, Inc.

5.3 SITE ACCESS

Access to the site will be controlled using the following method(s):

- Sign in/sign out log Guard
 Identification badges Other: AMEC will manage access to the site

5.4 GENERAL SAFE WORK PRACTICES

General safe work practices to be implemented during work activities at this site are included in Table 5.1.

TABLE 5-1
GENERAL SAFE WORK PRACTICES

<ul style="list-style-type: none">▪ Minimize contact with excavated or contaminated materials. Plan work areas, decontamination areas, and procedures accordingly. Store equipment, supplies, and drums at designated staging areas. Do not sit on drums or other materials. Do not sit or kneel on the ground in the Exclusion Zone or CRZ. Avoid standing in or walking through puddles or stained soil.▪ Smoking, eating, or drinking after entering the work zone and before decontamination will not be allowed. Use of illegal drugs and alcohol are prohibited.▪ Practice good housekeeping. Keep everything orderly and out of potentially harmful situations.▪ In an unknown situation, always assume the worst conditions.▪ Be observant of your immediate surroundings and the surroundings of others. It is a team effort to notice and warn of impending dangerous situations. Withdrawal from a hazardous situation to reassess procedures is the preferred course of action.▪ Conflicting situations may arise concerning safety requirements and working conditions and must be addressed and resolved rapidly by the SHSO and PC to relieve any motivations or pressures to circumvent established safety policies.▪ Unauthorized breaches of specified safety protocol will not be allowed. Workers unwilling or unable to comply with the established procedures will be discharged.

6.0 HAZARD ANALYSIS

Hazardous and associated safety information is presented below for both site contaminants and activity related hazards.

6.1 CONTAMINANTS OF CONCERN

Pertinent site information (e.g. records of chemicals used, records of disposal) and previous sampling data (e.g. groundwater, soil, sediment) have been reviewed to determine the contaminants of concern for this project. The known or suspected contaminants for the site are:

- Aluminum
- Antimony
- Arsenic
- Asbestos
- Barium
- Chromium
- Copper
- Iron
- Lead
- Polychlorinated Biphenyls (PCBs)
- Selenium
- Silver
- Zinc

Appendix D contains Contaminant Fact Sheets for each of these contaminants of concern.

Health hazards shall be evaluated using air monitoring equipment (Section 7.0) and controlled by implementing personal protective equipment (Section 8.0).

6.2 JOB HAZARD ANALYSIS

Job Hazard Analyses (JHAs) have been conducted for each task associated with this project in compliance with the AMEC (former Mactec) ESH 2.9.1 – Risk Assessment and Job Hazard Analysis Procedure. The “Field Work – General” JHA will cover all general oversight and documentation activities performed by AMEC during subcontractor work activities. The following JHAs can be found in Appendix E.

JHAs:

Activity Specific JHAs:

<input checked="" type="checkbox"/>	Mobilization/Demobilization and Site Preparation
<input checked="" type="checkbox"/>	Field Work – General
<input checked="" type="checkbox"/>	Decontamination
<input checked="" type="checkbox"/>	Soil Sampling – Direct Push
<input checked="" type="checkbox"/>	Excavating and Backfilling
<input checked="" type="checkbox"/>	Construction Inspection-Oversight
<input checked="" type="checkbox"/>	Asbestos Inspection
<input checked="" type="checkbox"/>	Site Perimeter Fence Installation
<input checked="" type="checkbox"/>	Drilling
<input checked="" type="checkbox"/>	Surveying
<input checked="" type="checkbox"/>	Industrial Hygiene Sampling
<input checked="" type="checkbox"/>	Chain Saw

Hazard Specific JHAs:

<input checked="" type="checkbox"/>	Insect Stings and Bites
<input checked="" type="checkbox"/>	Working Near Water
<input type="checkbox"/>	

7.0 AIR MONITORING

NOTE: Section 6.1 lists the known and suspected contaminant of concern at the site.

Table 7-1 table lists the monitoring instruments and upgrade/action limits that will be used at the site:

**Table 7-1
 Action Levels Per Monitoring Instrument**

Meter		Upgrade/Action Levels			
		Level D	Level C	Level B	Action
<input checked="" type="checkbox"/>	Photoionization Detector ¹				
<input type="checkbox"/>	9.0-10.6 eV				
<input checked="" type="checkbox"/>	11.0-11.7 eV	@ background	@ background	> background	
<input type="checkbox"/>	Flame Ionization Detector		≥	≥	
<input type="checkbox"/>	Detector Tubes ¹				
<input checked="" type="checkbox"/>	Dust Meter ²				
<input checked="" type="checkbox"/>	Respirable	< 0.16 mg/m ³	≥ 0.16 mg/m ³	≥ 1.6 mg/m ³	
<input type="checkbox"/>	Total				
<input checked="" type="checkbox"/>	LEL/O ₂ Meter				
<input type="checkbox"/>	LEL ²				
<input checked="" type="checkbox"/>	Oxygen ³	19.5% - 23.5%	19.5% - 23.5%	< 19.5% or > 23.5%	
<input type="checkbox"/>	Hydrogen Sulfide Meter		<		
<input type="checkbox"/>	Carbon Monoxide ¹				
<input type="checkbox"/>					

¹ Monitor source (e.g., well, cuttings, borehole, etc.)

² Monitor breathing zone refer to Appendix K for details

³ Monitor entry to sub-level structures (i.e., basements)

All work will be air monitored under the site-specific Lead Medical Monitoring Plan (Appendix K). Prior to entry into readily accessible subsurface areas (i.e., subfloors/basements) a photoionization detector (PID) will be used to field screen and monitor head space from each new entry point. If confined spaces are identified, only properly trained personal will have access to these areas. For soil sampling during drilling activities, a PID will be used to field screen head space from each soil boring location and each soil sample collected by the drilling subcontractor. PID results will be documented on field soil boring logs. If breathing zone levels on the PID exceed background, workers will stop work and back off due to the presence of unknowns. If elevated PID readings are still detected in the breathing zone above background, work can only proceed at Level B PPE. Areas of airborne dust and odor should be avoided. Skin contact with soil, sediment, surface water and groundwater should be avoided.

Dust monitoring will be conducted during daily work tasks and during soil removal/demolition activities. Daily dust monitoring will be conducted using a respirable dust meter on a daily basis and at least on the first day of each new task. The dust meter will be kept at or near the breathing zone during at the work area. Dust monitoring conducted during major earthwork/demolition activities will be completed using

up to five stationary dust sampling locations. The health concerns related to daily dust monitoring include lead and asbestos. Details on the dust monitoring are included in the Lead Medical Monitoring Plan (Appendix K).

7.1 PERSONAL AIR MONITORING

Personal air monitoring will be conducted at the Site during tasks that disturb asbestos containing materials (ACMs), including ACMs in soil. Known tasks include survey, fence installation, activity based sampling (ABS), asbestos inspections, soil removal and building demolition. Personal air monitoring will consist of a personal air sampling pump and sampling media cartridge attached to each person performing each task. The sampling pump flow rate will be calibrated to continuously collect a known volume of air over an 8-hour period. The sampling media cartridge will be submitted for laboratory analysis to determine the presence of asbestos. Personal air monitoring can be downgraded if sampling results indicate it is safe to do so. Details on asbestos air monitoring/sampling are presented in the attached Asbestos Monitoring and Sampling Plan (Appendix L).

7.2 AMBIENT AIR MONITORING

In order to determine the ambient/background airborne asbestos levels at the site, AMEC will collect five simultaneous air samples with high volume air sampling pumps during a period of no site activity. The air samples will be collected near each corner of the Site and an on-site area that has been identified as containing a significant amount of ACM. Additionally, high volume air samples will be collected from the same sample locations during periods of site activity that will significantly disturb the surface soil and/or materials (i.e. survey, fence installation, ABS, soil removal, building demolition, etc.) in order to determine the airborne asbestos concentrations during these events.

AMEC will record each sampling location with a GPS unit for future reference. The ambient/background airborne asbestos samples will be collected during dry conditions (no rain within 24 to 36 hours) and when winds are representative of area climatology based on historical weather information. AMEC will record and document weather conditions (i.e. wind speed, wind direction, temperature, and barometric pressure) prior to and hourly during the sample event. Weather data for the Site area is available from the Houghton County Memorial Airport located in Hancock, Michigan (approximately 4.5 miles southwest of the site) via National Weather Service radio and internet website. Wind direction will be monitored at the Site using a wind sock. The high volume air sampling pumps will be powered by onsite portable generators located downwind of each sampling point. Each sampling pump will have its own dedicated generator.

The samples will be collected using mixed cellulose ester (MCE) filters (25 millimeter, 0.8 micrometer pore space) in association with a high volume air sampling pump calibrated to 15 liters per minute (LPM) to capture asbestos fibers. The sampling pumps will be simultaneously run for 3.5 hours for a total sample volume of 3,150 liters per sample location. Each sample location will have a dedicated high volume air sampling pump (Dawson Model No. 1300 or Gast Model No. 1532). Sample filter cassettes will be attached to the sample pumps via unused 0.25-inch (ID) tygon tubing and secured to a tripod stand set to a height of four feet above the ground surface. A rotameter will be used to calibrate and measure the flow rate of each sample pump at the beginning and end of the test period. An average of the pre and post calibration rates will be used to calculate the total volume of air sampled. A sampling cassette from the same cassette sampling lot used for sample collection will be utilized for calibration purposes.

Upon completion of the air sample event, each sample cassette will be properly labeled for identification and location, placed into a sealable baggie, and submitted under chain of custody to an accredited contract asbestos laboratory that maintains a National Voluntary Laboratory Accreditation Program (NVLAP) for

analysis of asbestos fibers utilizing transmission electron microscopy (TEM) using National Institute for Occupational Safety and Health (NIOSH) Method 7402. The calculated sample volume for each air sample cassette will be included on the chain-of-custody. In addition to the air sample cassettes, one unused sample cassette (field blank) will be prepared at the site and submitted to the analytical laboratory for TEM analysis for quality assurance/quality control purposes. TEM is the most sophisticated technology available for characterizing asbestos fibers and is considered to be the standard for airborne asbestos investigations.

8.0 PERSONAL PROTECTIVE EQUIPMENT

The initial level of protection required for each task is provided in Section 1.0 and Table 8-1. The individual PPE required for each task is listed in the JHAs. Table 8-1 summarizes the PPE required for all tasks to be conducted by AMEC personnel and AMEC's subcontractors. The level of protection may be upgraded or downgraded according to the action guidelines provided in Section 7.0. Level of PPE used each day shall be indicated in the Field Logbook. When using PPE, workers must adhere to the company's Personal Protective Equipment Program (ESH Program 2.9.D) and OSHA regulations (29 CFR 1910.120[g] and 29 CFR 1910 Subpart I).

If respirators are worn, workers must adhere to the company's Respiratory Protection Program (ESH Program 2.9.C) and OSHA regulations (29 CFR 1910.134). Table 3.1 provides a record of the site workers' last annual fit test. Beards (e.g., facial hair interfering with the respirator seal) are not allowed when respirators are worn.

9.0 DECONTAMINATION

PPE shall be decontaminated as per 29 CFR 1910.120(k) and AMEC (former Mactec) ESH 2.9.A. The decontamination procedures, equipment, and decontamination solution required for each task are provided in the JHA – Decontamination (Appendix E) and Appendix F.

Re-usable safety gear will be washed with soap and water prior to re-use or removing from the work zone. Sampling tools, etc. will be decontaminated as described in the *Work Plan*, or as directed by the SHSO. All drilling fluids and cuttings will be handled in accordance with the *Work Plan*. The disposition of this material and disposable safety gear will be the responsibility of Honeywell. Safety gear that cannot be decontaminated will be disposed of as an investigative derived waste (IDW) in accordance with the *Work Plan*.

**Table 8-1
 PPE and Monitoring Requirements Summary**

Initial Level of PPE *				
<input type="checkbox"/> Level D	<input type="checkbox"/> Modified Level D	<input checked="" type="checkbox"/> Level C	<input type="checkbox"/> Level B	<input type="checkbox"/> Level A
Standard PPE				
<input checked="" type="checkbox"/> Hard Hat	<input checked="" type="checkbox"/> Safety shoes	<input checked="" type="checkbox"/> Safety glasses	<input checked="" type="checkbox"/> Boot Covers	<input type="checkbox"/> Rubber Boots
		<input type="checkbox"/> Aprons	<input checked="" type="checkbox"/> High Visibility Vest	
Eye and Face Protection				
<input type="checkbox"/> Welding glasses	<input type="checkbox"/> Welding helmet	<input type="checkbox"/> Face shield	<input type="checkbox"/> Chemical goggles	<input type="checkbox"/> Welding screens
Hearing Protection				
<input checked="" type="checkbox"/> Ear plugs	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Ear plugs and muffs	<input type="checkbox"/> Other _____	
Respiratory Protection				
<input type="checkbox"/> None	<input type="checkbox"/> Upgrade Only	<input checked="" type="checkbox"/> Full Face APR	<input type="checkbox"/> Half Face APR	Cart. Type: <u>MSA GMC or Equivalent</u>
		<input type="checkbox"/> PAPR		
<input type="checkbox"/> Airline respirator	<input type="checkbox"/> SCBA	<input type="checkbox"/> Dust mask	<input checked="" type="checkbox"/> <u>refer to lead and asbestos plans (Appendix K and L)</u>	
Protective Clothing				
<input checked="" type="checkbox"/> Tyvek® coveralls	<input type="checkbox"/> Poly-coated Tyvek®	<input type="checkbox"/> Saranex® Coveralls	<input type="checkbox"/> Fully encapsulating suit	
<input type="checkbox"/> Cotton coveralls	<input type="checkbox"/> Modesty Clothing	<input type="checkbox"/> Fire resistant clothing	<input type="checkbox"/> Other _____	
Hand Protection				
<input type="checkbox"/> None	<input type="checkbox"/> Cotton gloves	<input type="checkbox"/> Leather gloves	<input type="checkbox"/> Cut-resistant gloves	<input type="checkbox"/> Glove liners
<u>Outer Gloves</u>				
<input checked="" type="checkbox"/> Nitrile	<input type="checkbox"/> Viton®	<input type="checkbox"/> Butyl	<input type="checkbox"/> Neoprene	<input type="checkbox"/> Other _____
<u>Inner Gloves</u>				
<input type="checkbox"/> Nitrile	<input type="checkbox"/> Vinyl	<input type="checkbox"/> Latex	<input type="checkbox"/> Other _____	
Air Monitoring Requirements				
<input checked="" type="checkbox"/> Oxygen	<input type="checkbox"/> Flammable gases/vapors	<input checked="" type="checkbox"/> Toxic Gas/vapors	<input type="checkbox"/> Hydrogen Sulfide	Carbon Monoxide
<input checked="" type="checkbox"/> Asbestos (Appendix L)	<input type="checkbox"/> Full time IH coverage	<input type="checkbox"/> Part time IH coverage	<input type="checkbox"/> Be, Hg, Cr, Pb	
<input checked="" type="checkbox"/> Metals Specify: <u>lead (refer to Appendix K)</u>				
<input checked="" type="checkbox"/> Organic Vapors Specify: <u>A PID will be used to screen enclosed areas prior to entry (i.e. basement, enclosed areas),</u>				
<input type="checkbox"/> None	<input type="checkbox"/> TLD required	<input type="checkbox"/> CAM	<input type="checkbox"/> Radon	
<input type="checkbox"/> Full time RCT coverage	<input type="checkbox"/> Part time RCT coverage	<input type="checkbox"/> Radioactive air particulates	<input type="checkbox"/> Other _____	
<input checked="" type="checkbox"/> Other: daily dust monitoring for total dust		<input type="checkbox"/> Other:		

10.0 EMERGENCY RESPONSE

The following emergency response information is provided as per 29 CFR 1910.120(j), AMEC (former Mactec) ESH 2.9.A – Hazardous Waste Operations an Emergency Response Program.

10.1 HOSPITALS/CLINICS

A nearby Hospital (for emergency injuries needing immediate treatment) and a clinic (for non-emergency injuries) have been identified.

The hospital to be used for emergency treatment is (See Figure 10.1 for Route Map to Hospital):

Aspirus Keweenaw Hospital

205 Osceola Street
Calumet, Michigan 49913
(906) 337-6500

The clinic to be used for non-emergency treatment is (See Figure 10.2 for Route Map to Clinic):

Portage Health Medical Group

945 9th Street
Lake Linden, Michigan 49945
(906) 483-1030

10.2 EMERGENCY CONTACTS

A list of contacts and telephone numbers for the applicable local off-site emergency responders is provided in Table 10.1. The nature of the site work and contaminants of concern should be reviewed and the ability of off-site responders to respond to reasonably anticipated emergencies should be confirmed. If there are any concerns with off-site responsibilities they should be contacted directly.

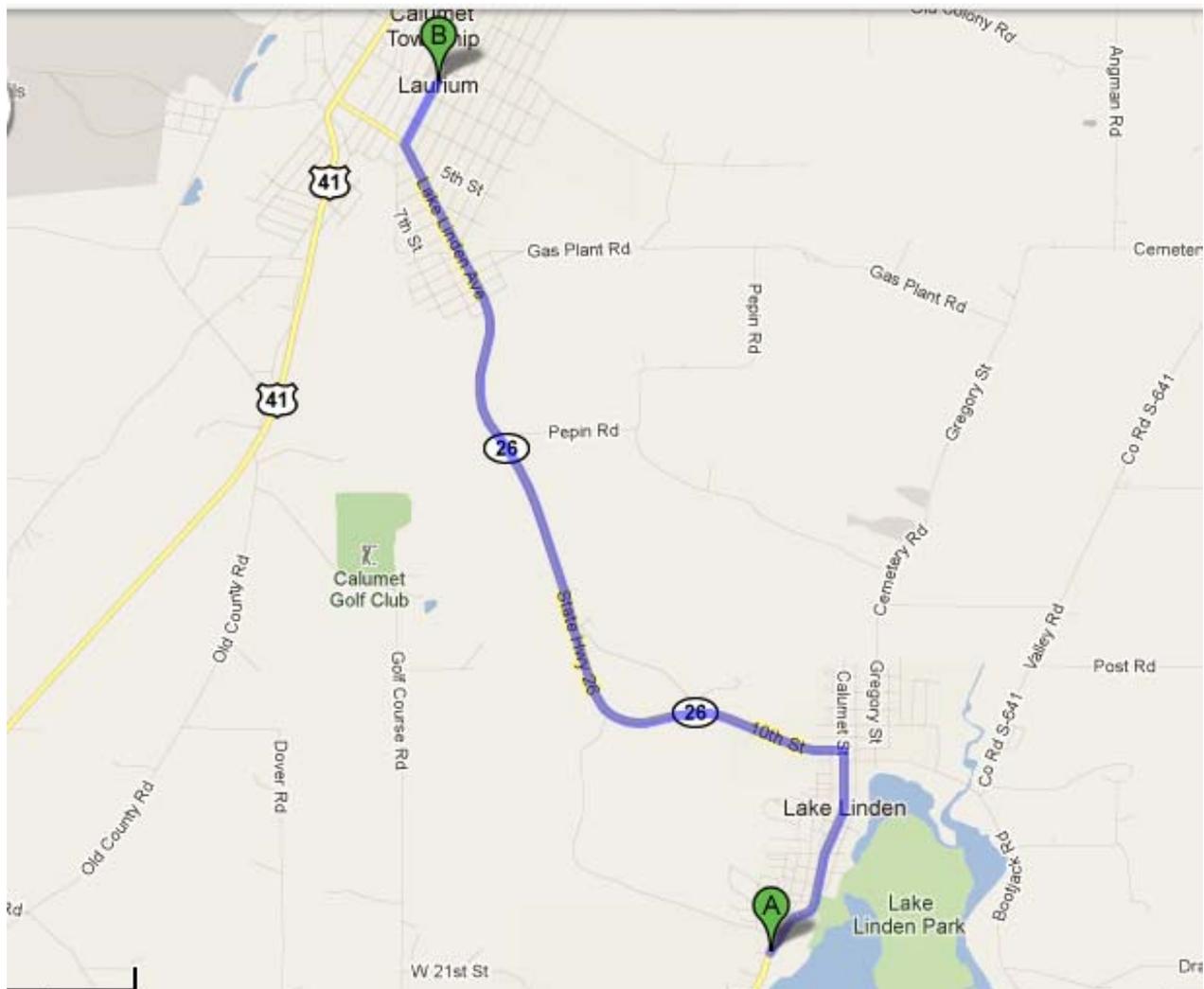
10.3 EMERGENCY RESPONSE EQUIPMENT

The following emergency response equipment is required for this project and shall be readily available.

- Field First Aid Kit
- Fire Extinguisher
 - Type A (Combustible materials)
 - Type B (Flammable liquids and gases)
 - Type C (Doesn't conduct electricity – to be used on electrical equipment)
 - Type ABC
- Eyewash (Note: 15 minutes of free-flowing fresh water)

- SCBA
- Shower
- Other: Respirator

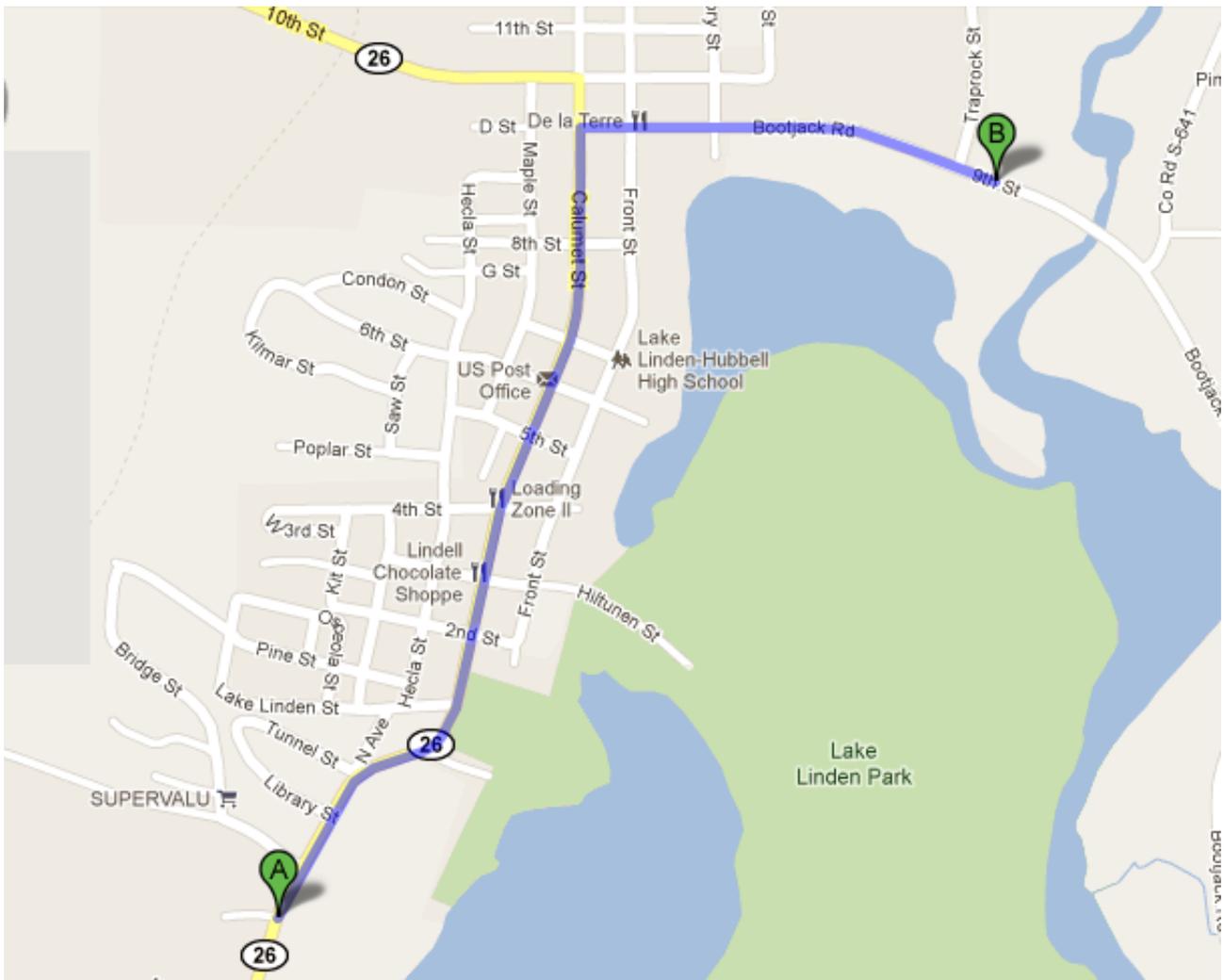
FIGURE 10-1



Directions to Aspirus Keweenaw Hospital:

1. Head **northeast** on **M-26 North** toward **M-26 North/10th Street** in downtown Lake Linden
2. Turn **left** onto **M-26 North/10th Street** (0.9 mi)
3. Continue on **M-26 North/10th Street** (3.6 mi)
4. Turn **right** at **Osceola Street**
5. Continue on **Osceola Street** (0.3 mi)
6. Destination on the **right** (**205 Osceola Street, Calumet, MI**)

FIGURE 10-2



Directions to Portage Health Medical Group:

1. Head **northeast** on **M-26 North** toward **M-26 North / 10th Street** in downtown Lake Linden
2. Turn **right** onto **9th Street / Bootjack Road** (0.9 mi)
3. Continue on **9th Street / Bootjack Road** (0.4 mi)
4. Destination on the **left (945 9th Street, Lake Linden, MI)**

TABLE 10-1
EMERGENCY CONTACTS

NAME	TELEPHONE NUMBERS		DATE OF PRE-EMERGENCY NOTIFICATION (if applicable)
Fire Department:	911		
Hospital: Aspirus Keweenaw Hospital 205 Osceola Street Calumet, Michigan 49913	(906) 337-6500		
Police Department:	911		
OTHER: Ambulance	911		
AMEC 24-Hour Emergency: WorkCare	1-888-449-7787		
Site Health And Safety Coordinator: Cindy Sundquist	Office: 207-828-3309 Home: 207-892-4402	Cell: 207-650-7593	
Site Health And Safety Officer: Douglas Saigh (ext. 3017)	Office: 248-926-4008	Cell: 586-382-0850	
Client Contact: Chuck Gadelmann	Office: 952-830-3685		
Project Manager: Dan Dyer (ext. 3026)	Office: 248-926-4008	Cell: 248-613-5753	
Coleman Engineering Company: Craig Reidner	Office: 906-774-3440	Cell: 282-3907	
EPA (Region 5): Ralph Dollhopf	Office: 231-264-8713	Cell: 231-301-0559	
EPA Consultant (Weston): Daniel Liebau	Office: 906-482-2361	Cell: 906-370-0524	
Poison Control Center (if applicable):	800-222-1222		

10.4 COMMUNICATIONS

On-site communications will be conducted through the use of:

- Verbal
- Two-way radio
- Cellular telephone
- Hand signals
 - Hand gripping throat Out of air, can't breathe
 - Grip partner's wrist or both hands around waist Leave area immediately
 - Hands on top of head Need assistance
 - Thumbs up OK, I am all right, I understand
 - Thumbs down No, negative
- Horn
- Siren
- Other: _____

Off-site communications will be conducted through the use of:

- Cellular phone
- Pay phone - location: _____
- Other: _____

10.5 EMERGENCY RESPONSE PROCEDURES

Emergency procedures are outlined in Table 10.2.

Injuries requiring medical treatment beyond first aid (as well as work-related vehicle incidents) will require the employee to submit a post incident drug test. It is the responsibility of the Supervisor/PM to ensure that the employee who has had an on-the-job incident as defined in AMEC (former Mactec) Human Resource Policy HR4-02B, Drug and Alcohol-Free Workplace Policy for Employees (in Section 3.2), submits to this required testing. The policy is located on the AMEC (former Mactec) Intranet under Human Resources for further information. The *Procedures for Post Accident and Reasonable Suspicion Testing* may be found on the Intranet (via the Incident Reporting Procedures link under "Medical Treatment"). Contact Cindy Sundquist, NREG HSE Manager, at (207) 828-3309, or Collette Myers at 770-360-0607, if you have any questions on incident-related drug testing.

10.5.1 AMEC Triage Program

If the emergency involves an injury to an AMEC employee, the LHSR or Field Lead is to implement the AMEC Triage program. Employees whose injuries are true emergencies and who need immediate medical attention will bypass this program and are to be immediately sent/taken to the hospital identified in Section 10.1.

For non-emergency injuries, the Supervisor (Field Lead or PM if on site) and the injured employee will contact WorkCare, the AMEC Triage Management and Reporting Line at **1-888-449-7787**. WorkCare will perform the intake process.

Figure 10.3 is a flow diagram that describes this procedure.

All incidents must be reported to the HSE department, verbally, within 60 minutes of the incident. You must speak directly to one of the HSE Managers when reporting an incident. Attempt to first contact Cindy Sundquist. If she is unavailable, contact another HSE Manager on the list. Refer to the Incident Reporting Flow Diagram (see Figure 10.3). Within 24 hours after any emergency response, the Incident Analysis Report (and Vehicle Incident Report if vehicle incident), provided in Appendix E, shall be completed and returned to the Regional HSE Manager, who will forward a copy to the Corporate HSE Manager and General Counsel.

10.6 HONEYWELL SPECIFIC ADVERSE EVENT REPORTING AND LESSONS LEARNED REQUIREMENTS

Adverse events are divided into three tiers: Tier 1 events are the most significant and serious events, followed by Tier 2, which are significant events but not as serious as Tier 1 events, and Tier 3 events are essentially all other events that do not meet the criteria for Tier 1 or Tier 2 events. Tier 1 events are to be reported within 2 hours, Tier 2 events are to be reported within 24 hours, and Tier 3 events are to be reported when possible.

Adverse events include the following:

10.6.1 Tier 1:

- A release to air, water, or soil that has an actual or potential off site adverse environmental impact;
- Any work-related fatality;
- Any work-related admission (employee, contractor, or visitor) to a hospital, beyond observation only;
- Any off site fatalities, injuries, or harmful exposures resulting from Honeywell products or operations;
- Fire, explosion, or other type of catastrophic failure that is reasonably expected to result in more than \$250,000 on site property damage or more than 2 days production stoppage;
- Government representatives alleging or suggesting criminal non-compliance of any kind;
- The receipt or notice of any regulatory agency directive or other type of injunctive device designed to curtail or restrict operations;
- Actual or likely adverse media coverage from an RES site-related event; and,
- Product transportation-related events that result in Tier 1 impacts.

10.6.2 Tier 2:

- Employee or contractor lost workday injuries/illnesses;
- Employee, contractor or visitor recordable injuries/illnesses;
- Agency, customer, or published reports of negative health/safety effects of operations/products;
- A release to air, water, or soil that is associated with subsequently diagnosed community injuries or illnesses;

- Environmental complaints from neighbors;
- Allegations of previously unknown health/environmental effects caused by products, processes, emissions, or discharges;
- Fire, explosion, or other catastrophic equipment failure that reasonably is expected to result in up to \$250,000 onsite property damage or 1 day production stoppage;
- Written notification from a governmental agency alleging non-compliance of any kind;
- Proposal or imposition of an HSER fine, penalty, or corrective action;
- Receipt of a non-routine request for information from a governmental agency;
- A non-routine regulatory agency inspection;
- Significant community activism or adverse media coverage not associated with an episodic event;
- A product recall imposed by a regulatory agency; and,
- Transportation-related event that results in Tier 2 impacts.

10.6.3 Tier 3:

- Any other event which a contractor wishes to record in the system, utilizing the system as a management tool.

Adverse events must be reported to the PM, the Honeywell engineering and construction manager, the RM, and the Honeywell portfolio director as soon as possible following the event. All Tier 1 and Tier 2 adverse events must be investigated and a written investigation report must be prepared and submitted to the Honeywell Event Reporting System (contact Steve Conn in Edina, MN AMEC office).

10.7 BLOODBORNE PATHOGENS

In the absence of an infirmary, clinic, hospital, or physician, that is reasonably accessible in terms of time and distance to the worksite, a person who has a valid certificate in first-aid training shall be available at the worksite to render first aid or CPR. Provisions shall be made, prior to commencement of the project, for prompt medical attention in case of serious injury. All employees who work on a site where bloodborne pathogens are known to be present or who have been designated, as a part of their work duties at the site, to respond to all first aid injuries, will have received bloodborne pathogen training at the time of initial assignment and annually thereafter.

10.7.1 Universal Precautions

Universal precautions is a method of infection control, which operates on the assumption that all human blood and bodily fluids are to be treated as if they are known to be infectious for Human immunodeficiency Virus, Hepatitis B virus, Hepatitis C virus, or other bloodborne pathogens. Universal Precautions will be observed to prevent contact with blood or other potentially infectious materials. All body fluids are to be considered potentially infectious materials.

Universal precautions consist of the following practices:

- All workers will protect their skin and mucous membranes against contact with blood or other bodily fluids. At a minimum, gloves and safety glasses shall be donned prior to administering first aid or otherwise touching blood and body fluids, mucous membranes, or non-intact skin and for handling items or surfaces contaminated

with blood or bodily fluids. Note: the gloves used selected to be used at this site to protect against chemical exposure will also protect against bloodborne pathogens.

- All first aid procedures involving blood or other potentially infectious materials will be performed in such a manner as to minimize splashing, spraying, spattering, and generation of droplets and aerosols of these substances.
- When there is a risk of exposure to the eyes, nose and mucous membranes from the generation of droplets of blood or other body fluids, masks and face shields shall be worn.
- Uncoated or polycoated Tyveks (or the suits provided in some bloodborne pathogen kits, shall be worn during procedures that are likely to generate splashes of blood or other body fluids.
- Hands and other skin surfaces shall be washed immediately and thoroughly if contaminated with blood or other bodily fluids. Flush mucous membranes with water immediately or as soon as feasible following contact of such body areas with blood or other potentially infectious materials.
- Hands must be washed with soap and water immediately or as soon as feasible after removal of gloves or other PPE used to perform first aid. When provision of hand washing facilities is not feasible, use appropriate antiseptic hand cleanser in conjunction with clean cloth/paper towels or antiseptic towelettes. When antiseptic hand cleansers or towelettes are used, hands shall be washed with soap and running water as soon as feasible.
- CPR masks or other ventilation devices will be available for use in areas in which the need for resuscitation is foreseeable.

All site first aid kits shall include bloodborne pathogen kits or supplies. These kits typically include, at a minimum, the CPR mask, gloves, safety glasses, and a red bag.

10.7.2 Decontamination/Laundering

If a garment(s) is penetrated by blood or other potentially infectious materials, the garment(s) shall be removed immediately or as soon as feasible. All PPE shall be removed prior to leaving the work area. When PPE is removed it shall be placed in an appropriately designated area or container for storage, washing, decontamination or disposal. In many States where waste is incinerated, if the blood doesn't drip from a material when compressed or if there is no risk of it flaking off during handling, the materials can be disposed of in the regular trash and does not need to be handled as bio-hazardous materials.

If personal clothing should become contaminated with blood or other body fluids, it shall be collected, bagged or containerized and appropriately labeled. Contaminated laundry shall be handled as little as possible with a minimum of agitation.

All equipment and environmental/working surfaces shall be cleaned and decontaminated with an appropriate disinfectant immediately after contact with blood or other potentially infectious materials or as soon as feasibly possible. A solution of one part bleach to nine parts water can be mixed and used as a disinfectant to clean/wipe down equipment and other surfaces.

Broken glassware or other sharps which may be contaminated shall not be picked up directly with the hands. It shall be cleaned up using mechanical means, such as a brush and dust pan, tongs, or forceps and disposed of in a sturdy container.

10.7.3 Vaccines, Evaluation, Follow-Up

Hepatitis B vaccines will be available to all AMEC employees who may have an occupational exposure. Post-exposure evaluation and follow-up will be conducted on all employees who have had an exposure incident.

TABLE 10-2

EMERGENCY PROCEDURES

- The SHSO (or alternate) should be immediately notified via the on-site communication system. The SHSO assumes control of the emergency response.
- The SHSO notifies the Project Manager of the emergency, who will then notify the client contact. The SHSO shall then contact the Health, Safety and Environment Coordinator who will then contact the Health, Safety and Environment Manager.
- If applicable, the SHSO shall notify off-site emergency responders (e.g. fire department, hospital, police department, etc.) and shall inform the response team as to the nature and location of the emergency on-site.
- If applicable, the SHSO evacuates the site. Site workers should move to the predetermined evacuation point (See Site Map).
- For small fires, flames should be extinguished using the fire extinguisher. Large fires should be handled by the local fire department.
- In an unknown situation or if responding to toxic gas emergencies, appropriate PPE, including SCBAs, should be donned.
- If chemicals are accidentally spilled or splashed into eyes or on skin, use eyewash and/or shower.
- If a worker is injured, first aid shall be administered by certified first aid provider.
- Before continuing site operations after an emergency involving toxic gases, the SHSO shall don a SCBA and utilize appropriate air monitoring equipment to verify that the site is safe.
- An injured worker shall be decontaminated appropriately.
- After the response, the SHSO shall follow-up with the required company reporting procedures, including the Incident Analysis Forms (Appendix G).

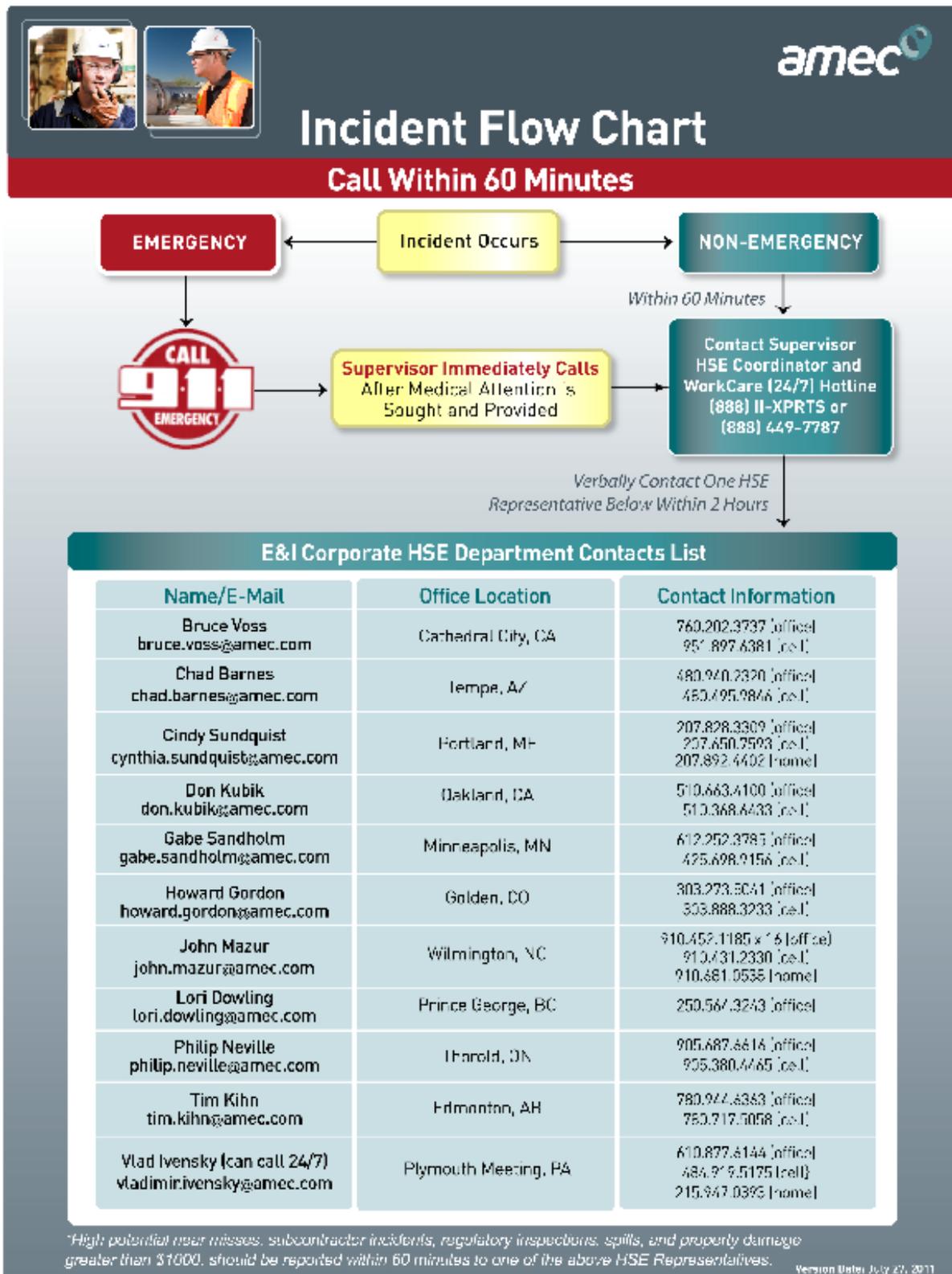
Injuries requiring medical treatment beyond first aid (as well as work-related vehicle incidents) will require the employee to submit a post incident drug test. It is the responsibility of the Supervisor/PM to ensure that the employee who has had an on-the-job incident as defined in AMEC (formally MACTEC's) Human Resource Policy HR4-02B, Drug and Alcohol-Free Workplace Policy for Employees (in Section 3.2), submits to this required testing. The policy is located on the AMEC (former MACTEC) Intranet under Human Resources for further information. The *Procedures for Post Accident and Reasonable Suspicion Testing* may be found on the Intranet (via the Incident Reporting Procedures link under "Medical Treatment"). Contact Cindy Sundquist, North Region HSE Manager, at (207) 828-3309, or Collette Myers at 770-360-0607, if you have any questions on incident-related drug testing.

10.7.4 AMEC Early Injury Case Management Program

If the emergency involves an injury to an AMEC employee, the HSE Coordinator or Field Lead are to implement the AMEC Early Injury Case Management program. See procedures below:

NON-EMERGENCY INCIDENT	EMERGENCY INCIDENT
<p>Steps 1 & 2 must be completed before seeking medical attention other than local first aid.</p> <ol style="list-style-type: none"> 1. Provide first-aid as necessary. Report the situation to your immediate supervisor AND HSE coordinator (all incidents with the apparent starting event should be reported within 1 hour of occurrence). 2. Injured employee: 	<ol style="list-style-type: none"> 1. Provide emergency first aid. Supervisor on duty must immediately call 911 or local emergency number; no employee may respond to outside queries without prior authorization. Any outside media calls concerning this incident must be referred immediately to the Project Manager. 2. Once medical attention is sought and provided, the supervisor must:
<p>Call WorkCare 24/7 Hotline*</p> <p>(888) 88-XPRTS or (888) 449-7787</p>	
<p>WorkCare will assess the situation and determine whether the incident requires further medical attention. During this process, WorkCare will perform the following:</p> <ul style="list-style-type: none"> • Explain the process to the caller. • Determine the nature of the concern. • Provide appropriate medical advice to the caller. • Determine appropriate path forward with the caller. • Maintain appropriate medical confidentiality. • Help caller to execute path forward, including referral to the appropriate local medical facility. • Send an email notification to the Corporate HSE Department. 	<p>WorkCare will be responsible for performing the following:</p> <ul style="list-style-type: none"> • Contact the treating physician. • Request copies of all medical records from clinic. • Send an email update to the Corporate HSE Department.
<ol style="list-style-type: none"> 3. IMMEDIATELY after contacting WorkCare send a brief email notification AND inform verbally (direct contact is required) ONE of HSE corporate representatives See Figure 11.3. 4. Make all other local notifications and client notifications. 5. Local Supervisor, HSE Coordinator, SSHO and any applicable safety committees to complete preliminary investigation, along with the initial Incident Report within 24 hours. 6. Corporate Loss Prevention Manager to complete Worker’s Compensation Insurance notifications as needed. 7. Corporate HSE to conduct further incident notifications, investigation, include in statistics, classify, and develop lessons learned materials. <p>* - NOTE: Step 2 is only applicable to the North-American operations and to incidents involving AMEC personnel. High potential near misses, subcontractors’ incidents, regulatory inspections, spills and property damages above \$1,000 should be reported immediately, following directions from Step 3.</p>	

**FIGURE 10.3
 INCIDENT REPORTING FLOW DIAGRAM**



CONFINED SPACE ENTRY

Yes No
 The task(s) for this project involve confined space entry.

If yes, see applicable JHA in Appendix B.

11.0 SPILL CONTAINMENT

Yes No
 The task(s) for this project involve drum/tank/container sampling, excavation, transportation, etc.

Details on work specific spill containment procedures are explained in attached AMEC Spill Control Plan (Attachment H).

12.0 HAZARD COMMUNICATION

The following procedures shall be followed for all chemicals brought on site (e.g., decontamination solution, sample preservatives, etc.):

- Chemical containers (primary and secondary) shall be correctly and clearly labeled with the name of the chemical and the hazard(s) associated with that chemical (e.g. flammable, corrosive, etc.).
- Workers have received training on the hazards of these chemicals as indicated in Table 3.1.
- A Material Safety Data Sheet for each chemical listed below is included in Appendix I.

<u>Alconox</u>	<u>High Temperature Grease</u>
<u>Isobutylene (gas)</u>	<u>Hole Plug 38</u>
<u>Antifreeze</u>	<u>Hole Plug 34</u>
<u>Bentonite</u>	<u>Kerosene</u>
<u>LaFarge Cement</u>	<u>Marking Paint</u>
<u>Medusa Portland Cement</u>	<u>Tree Marking Paint</u>
<u>Portland Cement</u>	<u>Metal Cutting Fluid</u>
<u>St. Mary’s Portland Cement</u>	<u>Motor-Petroleum Lubricant</u>
<u>Corebits</u>	<u>Motor Oil 2002</u>
<u>Diesel Fuel #4</u>	<u>2 Cycle Motor Oil</u>
<u>Expo Dry Erase Cleaner</u>	<u>Motor Oil</u>
<u>Dry gas</u>	<u>Pressure Gauge 2.5 inch</u>
<u>Enviroplug</u>	<u>Quick-Gel</u>
<u>Thermometer, Spirit Filled</u>	<u>Turpentine</u>
<u>Windex</u>	<u>Silica Sand</u>
<u>Gasoline</u>	

When chemicals are used on site, workers must adhere to the company's Hazard Communications Program (ESH Program 2.9.E) and the OSHA regulation (29 CFR 1910.1200).

13.0 RECORD KEEPING

At the end of the project, the following items shall be maintained in the project file:

- HASP
- Incident Analysis Forms (if applicable)
- SHSO Summary (Appendix J)

FIGURES



Source: USGS, Laurium Quad, 1980

Legend

 Approximate Property Boundary



Prepared By: BSM Approved By: GEB
 Checked By: JDG Date: 7/22/2011

**Figure 1.1
 Site Location Map**

Former C & H POWER PLANT SITE
 LAKE LINDEN,
 HOUGHTON COUNTY, MICHIGAN
 Project 3293-11-1440



Source: NAIP, 2010

Legend

- Approximate Property Boundary
- Gravel Road
- Building
- Berm



Prepared By: BSM Approved By: GEB
 Checked By: JDG Date: 7/22/2011

**Figure 1.2
 Site Features Map**

Former C & H POWER PLANT SITE
 LAKE LINDEN,
 HOUGHTON COUNTY, MICHIGAN
 Project 3293-11-1440

APPENDIX A
SITE SAFETY ORIENTATION FORM

SITE SAFETY ORIENTATION

Project: _____ Site: _____

Project Number: _____ Date: _____

All applicable items listed below are to be reviewed on the first day of site activities and when new workers arrive on site. Training provider, please initial each item covered in the training, or note "NA" as applicable.

General Supervisor: _____

Site Health and Safety Supervisor (SHSS): _____

Employees' direct supervisor:..... _____

Location of HASP and MSDS on site:..... _____

HazCom labeling system if different from Local Operation: _____

Site-specific medical surveillance requirements:..... _____

Site control measures (location of exclusion zone, etc.):..... _____

Safety and health hazards on site: _____

The Level of Protection and specific PPE to be used: _____

Work practices to be used on site to minimize exposure: _____

Decontamination procedures: _____

How to effectively use site/task engineering controls: _____

Applicable elements of the site emergency response plan:..... _____

Any other site-specific health and safety related requirements: _____

Participating employees must print and sign their name in the spaces provided below:

_____	_____
_____	_____
_____	_____
_____	_____

APPENDIX B

DAILY TAILGATE SAFETY MEETING CHECKLIST

AMEC ENVIRONMENT & INFRASTRUCTURE, INC.

DAILY TAILGATE SAFETY MEETING CHECKLIST

Project: _____ Site: _____
 Date: _____ Location: _____

To be reviewed on the first day of site activities and when new workers arrive on site:
 Alternate for Health & Safety: _____
 Location of on-site HASP: _____
 Site training requirements: See HASP
 Specific medical surveillance requirements: See HASP

Agenda:

During the project, one or more of the agenda items could be selected for the required daily site training.

Check-off:
Date

1. Planned work for this day (discuss)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Physical hazards and controls (discuss/review)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Chemical hazards and controls (discuss/review)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Biological hazards and controls (discuss/review)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Personal protective equipment Modified D	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Personal protective equipment required per the hazard assessment:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SPECIFY TYPE					
Protective coveralls					
Safety glasses/goggles		<u>ANSI approved</u>			
Hard hat		<u>ANSI approved</u>			
Foot protection		<u>Safety toe boots & overboots</u>			
Work gloves					
Chemical gloves		<u>Neoprene outer, nitrile inner</u>			
Hearing protection					
Other					
7. Review inspection, decontamination, and maintenance procedures and the limitations of the above stated PPE.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Decontamination procedure (discuss/review)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Exclusion zone maintained	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Site emergency response plan (discuss/review)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Signs and symptoms of overexposure to chemicals anticipated on site	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. General health and safety rules	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Specific health and safety requirements relating to site activities including: (discuss/review)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Drilling/boring	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. UST	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Excavations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Heavy equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Slips, trips, and falls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Lockout/tagout	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Working in temperature extremes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Rain or other weather advisories	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Other health & safety issues (discuss/note)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

APPENDIX C

WEEKLY SITE SAFETY AND HEALTH CHECKLIST

AMEC ENVIRONMENT & INFRASTRUCTURE, INC.

WEEKLY SITE SAFETY AND HEALTH CHECKLIST

Site: _____ Date: _____

Project Number: _____ Project Manager: _____

Conducted by: _____

Names of AMEC employee's onsite: _____

	Y	N	NA
HASP, Training and Documentation:			
1. Are emergency phone numbers posted?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Are directions to the nearest emergency medical care posted?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Is the OSHA Poster posted?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Is there a SSHP at the site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
a. Is it current and address all tasks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Does it address all know/suspected hazards?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Are JHAs included for <u>all</u> tasks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Are employees following the procedures as outlined in the JHAs?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Is it approved?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Have all field members signed off that they have read it?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Are there MSDSs for required materials/chemicals brought to the site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Are all containers properly labeled, as to content, hazard?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Is there list of chemicals brought to the site? Do the names on the list match the name on the label and MSDS?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Do applicable workers have their 40-hour initial training and are current in their refreshers?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Do the Field Lead and Health and Safety Officer have Supervisory training?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Are all applicable workers current in their physicals?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Are Tailgate Safety Meetings taking place and documented?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Are there means to minimize heat or cold stress on-site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Is eating, drinking, smoking, etc. only done in areas free from toxic materials?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Are two people used to lift equipment or materials weighting more than 50 lbs.?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Are the locations of electrical power lines and other utilities identified prior to digging or drilling?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PPE and Monitoring Instruments:			
16. Does the PPE being worn match what is required in the HASP and JHAs?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Is hearing protection worn when noise makes conversation difficult at a distance of 2 feet?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Are approved respirators and cartridges worn when needed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
a. Are cartridges changed daily, unless specified otherwise in the HASP?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Are cartridges appropriate for the contaminants at the site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Are <u>all</u> air monitoring instruments identified in the HASP being used and calibrated daily, as required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
a. Do employees know upgrade/downgrade action levels?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
First Aid:			
20. Are there eyewash bottles on-site? Solution not expired?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Are first aid kits on-site and adequately stocked (including bloodborne pathogen equipment)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Is there always at least one person on site current in their first aid/CPR training?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fire Safety:			
23. Is there a charged fire extinguisher on-site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
a. Have AMEC workers, who would use extinguishers, received fire extinguisher training in past year?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Are fire extinguishers visually inspected monthly and are the inspections documented?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Have fire extinguishers been professionally inspected within the past year?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. Are flammable liquids (e.g., gasoline) being stored safety (e.g., in safety cans and 20 feet from combustibles)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Are flammable liquid dispensing systems bonded (metal to metal)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Compressed Gas:			
26. Are cylinders stored in a secure manner, with caps on, upright and protected from damage?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27. Are cylinders protected from snow, rain, etc.?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28. Are cylinder caps in place before cylinders are moved?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. Are fuel gas and oxygen cylinders stored a minimum of 20 feet apart?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. Are propane cylinders stored and used only outside of buildings?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

AMEC ENVIRONMENT & INFRASTRUCTURE, INC.

WEEKLY SITE SAFETY AND HEALTH CHECKLIST

	Y	N	NA
Vehicles:			
31. Are employees wearing their seat belts and not talking on cell phones while car is in motion?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32. Do Company vehicles have the "How's my Driving" decals?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33. Are vehicles parked in a safe manner? Are traffic cones used, if required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34. Are company vehicle inspected weekly and the inspections documented?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35. Are materials stored in vehicles in a neat, orderly and secure manner so that they won't become a distraction to the driver, become a projectile hazard in the event of a sudden stop or crash or fall from the vehicle when in transport?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Electrical:			
36. Is at least a 10 foot clearance maintained between equipment and power lines?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37. Are all electrically operated tools grounded?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38. Are GFCI's used?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39. Are exposed wiring and cords in good condition (not frayed or deteriorated)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40. Do extension cords have a grounding conductor?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
41. Are extension cords only used in one continuous length (not daisy chained)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
42. Are extension cords kept out of wet areas?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
43. Has a lockout/tagout system been established, if required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hand and Power Tools:			
44. Are tools and equipment used by employees in good condition or tagged out of service?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
45. Are guards and safety devices in place on power tools?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Walking and Working Surfaces:			
46. Do stairways into trailers/buildings that have 4 steps or more, have hand rails?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
47. Is good housekeeping being maintained at the site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
48. Are all ladders in good condition, stored against damage and properly secured when in use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
49. Are approved manlifts provided for the lifting of personnel (e.g., cherry pickers, scissor lifts, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
50. Are personnel in manlifts wearing approved fall protection devices when required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
51. Is fall protection used when working at elevations greater than 6 feet?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
52. Are ladders inspected prior to use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
53. Are all ladders in good condition and defective ladders tagged out of service?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scaffolding:			
54. Is scaffolding placed on a flat, firm surface?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
55. Are scaffold planks free of mud, ice, grease, etc.?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
56. On scaffolds where platforms are overlapped, is planking overlapped a minimum of 12 inches?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
57. Does scaffold planking extend over end supports between 6 to 18 inches (dependent upon platform length)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
58. Are employees restricted from working on scaffolds during storms and high winds?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
59. Is required perimeter guarding (top rail, mid rail, and toe board) present?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
60. Has a competent person been designated to oversee scaffold construction and inspect daily?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Excavations:			
61. Has entrance into excavations greater than 4 feet deep prohibited unless the following precautions are taken?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
a. The sides of excavations sloped or shored to prevent cave ins if over 5 feet deep?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Excavations greater than 4 feet deep been monitored for hazardous atmospheres (i.e., LEL/O2)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Ladders or ramps used in excavations over 4 feet deep?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Means of egress available so as to require no more than 25 feet of lateral travel?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Excavation inspected daily by competent persons and documented?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
62. Is excavated material placed a minimum of 24 inches from the excavation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Heavy Equipment:			
63. Is heavy equipment shut down for fueling and maintenance?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
64. Are backup alarms installed and working on mobile equipment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
65. Are riders prohibited on heavy equipment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
66. Are guards and safety appliances in place and used?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
67. Are operators using the "three point" system when mounting/dismounting equipment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Confined Space Entry:			
68. Are there confined spaces at the site that AMEC will be entering? If yes:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
a. Is the permit completely filled out and approved prior to entry?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Are confined spaces thoroughly emptied of the hazardous substances prior to entry?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Is ventilation provided prior to entry?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Is air within the confined space tested for oxygen deficiency, LEL and toxic substances in that order?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Is there an assigned safety standby outside the space who is adequately trained?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

APPENDIX D

CONTAMINATE FACT SHEETS

APPENDIX D

CONTAMINANT FACT SHEET

 <p style="margin: 0;">CONTAMINANT FACT SHEET</p> <p style="margin: 0;">Chemical Name: <u>Aluminum</u></p> <p style="margin: 0;">7429-90-5</p> <p style="margin: 0;">Synonyms: <u>Aluminum meta</u> <u>elemental aluminum</u></p>					HEALTH HAZARD DATA									
					Color:	<u>Silvery-white</u>			Carcinogen:	OSHA _____ IARC _____ NTP _____ ACGIH _____ NIOSH _____			Source	TWA (units)
Physical State	Solid	<u>X</u>		Skin absorbable	yes ___ no <u>X</u>			OSHA PEL	15 mg/m ³					
	Liquid	_____		Skin corrosive	yes ___ no <u>X</u>			ACGIH TLVs	10 mg/m ³					
	Gas	_____		Signs/Symptoms of Acute Exposure	<u>Irritates eyes, skin, and respiratory system</u>			NIOSH RELS	10 mg/m ³					
Odor:	<u>none</u>													
Odor Threshold:	<u>NA</u>													
Vapor Density	<u>NA</u>													
Ionization Potential (IP)	<u>NA</u>													
IDLH:	<u>No Evidence</u>													
AIR MONITORING					PERSONAL PROTECTIVE EQUIPMENT					FIRE/REACTIVITY DATA				
Type	Brand/Mode No.	Calibrations Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level	<u>Recommended Protective Clothing Material:</u>					Flash Point: <u>NA</u>				
					Suits _____					LEL/UEL: <u>Not Combustible</u>				
					Gloves <u>Any chemical - resistan</u>					<u>Fire Extinguishing Media</u>				
					Boots _____					Dry Chemical <u>X</u> Foam _____				
Not Applicable (NA)					Service Limit Concentration (ppm) <u>NA</u>					Water Spray _____ CO ₂ _____				
					MUC 1/2 Mask APR=TWA x 10= <u>150 mg/m³</u>					<u>Incompatibilities</u>				
					MUC Full-Face APR=TWA x 10= <u>150 mg/m³</u>					Strong oxidizers and acid: _____				
										halogenated hydrocarbon: _____				
Checked by: Emmet F. Curtis					Date: 1/3/00									

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Note: The recommended protective clothing materials assumes that potential for direct contact (by splashing, dust inhalation, or other means) with the contaminants exists. Professional judgment and knowledge of on-site hazards should be used in selecting PPE appropriate to the concentration of the contaminant (trace vs percentage) to which the individual is likely to be exposed.

APPENDIX D

CONTAMINANT FACT SHEET

CONTAMINANT FACT SHEET					HEALTH HAZARD DATA									
Chemical Name: <u>Antimony</u> CAS Number: <u>7440-36-0</u> Synonyms: <u>Antimony meta</u> <u>Stibium</u>					Color: <u>Silver-white or dark gra</u>	Carcinogen: OSHA _____ IARC _____ NTP _____ ACGIH _____ NIOSH _____ Skin absorbable: yes ___ no <u>X</u> Skin corrosive: yes ___ no <u>X</u>			Source	TWA (units)	STEL (units)	C (units)		
					Physical State: Solid <u>X</u> Liquid _____ Gas _____				OSHA PEL	0.5 mg/m ³				
					Odor: <u>NA</u>				ACGIH TLVs	0.5 mg/m ³				
					Odor Threshold: <u>NA</u>				NIOSH RELs	0.5 mg/m ³				
Vapor Density: <u>NA</u>	Signs/Symptoms of Acute Exposure Irritates eyes, skin, nose, throat, mouth <u>coughing; dizziness; headache; nausea;</u> <u>vomiting; diarrhea; stomach cramps</u> <u>insomnia, anorexia, unable to smell proper</u>													
Ionization Potential (IP): <u>NA</u>	IDLH: <u>50 mg/m³</u>													
AIR MONITORING					PERSONAL PROTECTIVE EQUIPMENT					FIRE/REACTIVITY DATA				
Type	Brand/Mode No.	Calibrations Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level	<u>Recommended Protective Clothing Material:</u> Suits _____ _____ _____ Gloves: <u>Any chemical-resistan</u> _____ _____ Boots: _____ _____ _____ _____					Flash Point: <u>NA</u> LEL/UEL: <u>NA*</u> <u>Fire Extinguishing Media</u> Dry Chemical: <u>X</u> Foam: _____ Water Spray: _____ CO ₂ : <u>X</u>				
Not Applicable (NA)					Service Limit Concentration (ppm) <u>NA</u>					<u>Incompatibilities</u> Strong oxidizers, acids, halogenated acid *Moderate explosive hazard when present in powdered form				
					MUC 1/2 Mask APR=TWA x 10= <u>5 mg/m³</u> MUC Full-Face APR=TWA x 10= <u>5 mg/m³</u>									
Checked by: Emmet F. Curtis					Date: 11/20/03									

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Note: The recommended protective clothing materials assumes that potential for direct contact (by splashing, dust inhalation, or other means) with the contaminants exists. Professional judgment and knowledge of on-site hazards should be used in selecting PPE appropriate to the concentration of the contaminant (trace vs percentage) to which the individual is likely to be exposed.

APPENDIX D

CONTAMINANT FACT SHEET

CONTAMINANT FACT SHEET					HEALTH HAZARD DATA									
<p>Chemical Name: <u>Arsenic</u></p> <p>CAS Number: <u>7440-38-2</u></p> <p>Synonyms: <u>Arsenia</u></p>					Color: <u>Silver-grey or tin-white</u>		Carcinogen: OSHA <u> X </u>			Source	TWA (units)	STEL (units)	C (units)	
					Physical State: Solid <u> X </u>		IARC <u> X </u>							OSHA PELs
					Liquid <u> </u>		NTP <u> X </u>							
					Gas <u> </u>		ACGIH <u> X </u>							
					Odor: <u>odorless</u>		NIOSH <u> X </u>			Skin absorbable: yes ___ no <u> X </u>				
Odor Threshold: <u>NA</u>		Skin corrosive: yes ___ no <u> X </u>			ACGIH TLVs			0.01 mg/m ³						
Vapor Density: <u>NA</u>		Signs/Symptoms of Acute Exposure			NIOSH RELs			0.002 mg/m ³						
Ionization Potential (IP): <u>NA</u>		Respiratory irritation, GI disturbance:												
IDLH: <u>5 mg/m³</u>		Dermatitis												
AIR MONITORING					PERSONAL PROTECTIVE EQUIPMENT					FIRE/REACTIVITY DATA				
Type	Brand/Mode No.	Calibrations Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level	Recommended Protective Clothing Material:					Flash Point: <u>NA</u>				
Not Applicable					Suits <u>Any chemical-resistan</u>					LEL/UEL: <u>NA / NA</u>				
					Gloves <u>Any chemical-resistan</u>					Fire Extinguishing Media				
					Boots <u>Any chemical-resistan</u>					Dry Chemical <u> X </u> Foam <u> X </u>				
					Service Limit Concentration (ppm) <u>NA</u>					Water Spray <u> X </u> CO ₂ <u> X </u>				
					MUC 1/2 Mask APR = TWA x 10 = <u>0.05 mg/m³</u>					Incompatibilities				
					MUC Full-Face APR = TWA x 10 = <u>0.05 mg/m³</u>					Strong oxidizers, bromine azide				
Checked by: <u>Emmet F. Curtis</u>					Date: <u>12/5/03</u>					Hydrogen gas can react with arsenic to form the highly toxic gas arsine				

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Note: The recommended protective clothing materials assumes that potential for direct contact (by splashing, dust inhalation, or other means) with the contaminant exists. Professional judgement and knowledge of on-site hazards should be used in selecting PPE appropriate to the concentration of the contaminant (trace vs percentage) to which the individual is likely to be exposed.

ATTACHMENT D

CONTAMINANT FACT SHEET

<p>CONTAMINANT FACT SHEET</p> <p>Chemical Name: ASBESTOS</p> <p>CAS Number: 13332-21-4</p> <p>Synonyms: Actinolite, Amosite, Chrysotile, Anthophyllite, Crocidolite, Tremolite</p>	HEALTH HAZARD DATA																											
	Color: <u>white, blue, brown</u> <u>green, gray</u>		Physical State: Solid <input checked="" type="checkbox"/> Liquid _____ Gas _____		Odor: <u>odorless</u>		Odor Threshold: <u>NA</u>		Vapor Density: <u>NA</u>		Vapor Pressure: <u>NA</u>		Ionization Potential (IP): <u>NA</u>		IDLH: <u>Ca [ND]</u>		Carcinogen: OSHA <u>X</u> IARC _____ NTP _____ ACGIH _____ NIOSH <u>X</u>		Skin absorbable: Yes _____ No <u>X</u> Skin corrosive: Yes _____ No <u>X</u>		Source		TWA (units) ppm		STEL (units) ppm		C (units) ppm	
																	OSHA PELs		0.1 fiber/cm3									
																	ACGIH TLVs		NA									
																	NIOSH RELs		0.1 fiber/cm3									
AIR MONITORING					PERSONAL PROTECTIVE EQUIPMENT					FIRE/REACTIVITY DATA																		
Type	Brand/Model No.	Calibrations Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level	<u>Recommended Protective Clothing Materials</u>					Flash Point: <u>NA</u>																		
Personnal Air Pump	Any	1 Liter/minute	NA	<1 fiber per 30 minutes	Suits <u>Any-air tight</u>					LEL/UEL: <u>NA / NA</u>																		
					Gloves <u>Any-air tight</u>					<u>Fire Extinguishing Media:</u>																		
					Boots <u>Any-air tight</u>					Dry Chemical <u>X</u> Foam <u>X</u>																		
					Service Limit Concentration (ppm) <u>NA</u>					Water Spray <u>X</u> CO ₂ <u>X</u>																		
					MUC 1/2 Mask APR = TWA x 10 = 1 fiber/cm3					<u>Incompatibilities:</u>																		
					MUC Full-Face APR = TWA x 10 = 1 fiber/cm3					Non-combustible																		
Checked by: Eric Gavalier					Date: 8/20/2009																							

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Note: The recommended protective clothing materials assumes that potential for direct contact (by splashing, dust inhalation, or other means) with the contaminants exists. Professional judgment and knowledge of on-site hazards should be used in selecting PPE appropriate to the concentration of the contaminant (trace vs percentage) to which the individual is likely to be exposed.

APPENDIX D

CONTAMINANT FACT SHEET

HEALTH HAZARD DATA														
CONTAMINANT FACT SHEET Chemical Name: <u>Barium</u> CAS Number: <u>7440-39-3</u> Synonyms: <hr/> <hr/>	Color:	<u>White</u>	Carcinogen: OSHA	<u> </u>	Source	TWA (units)	STEL (units)	C (units)						
	Physical State	Solid <input checked="" type="checkbox"/>	Liquid <input type="checkbox"/>	IARC	<u> </u>	OSHA PEL	0.5 mg/m ³							
		Gas <input type="checkbox"/>	NTP	<u> </u>										
			ACGIH	<u> </u>										
	Odor:	<u>None</u>		NIOSH	<u> </u>	ACGIH TLVs	0.5 mg/m ³							
Odor Threshold:	<u>NA</u>		Skin absorbable	yes <input type="checkbox"/> no <input checked="" type="checkbox"/>										
Vapor Density	<u>NA</u>		Skin corrosive	yes <input type="checkbox"/> no <input checked="" type="checkbox"/>	NIOSH RELs	0.5 mg/m ³								
Ionization Potential (IP)	<u>NA</u>		Signs/Symptoms of Acute Exposure											
IDLH:	<u>50 mg/m³</u>		Upper respiratory tract irritation, gastroenteritis, muscle spasms, slow pulse, eye/skin irritant, slow heart rate											
AIR MONITORING					PERSONAL PROTECTIVE EQUIPMENT					FIRE/REACTIVITY DATA				
Type	Brand/Mode No.	Calibrations Method/Medic	Relative Response or Conversion Factor	Meter Specific Action Level	Recommended Protective Clothing Material:					Flash Point: <u>NA</u>				
Not Applicable (NA)					Suits	<u>Any chemical - resistan</u>				LEL/UEL: <u>Not Combustible *</u>				
					Gloves	<u>Any chemical - resistan</u>				Fire Extinguishing Media				
					Boots	<u>Any chemical - resistan</u>				Dry Chemical <input checked="" type="checkbox"/> Foam <input type="checkbox"/>				
										Water Spray <input type="checkbox"/> CO ₂ <input type="checkbox"/>				
					Service Limit Concentration (ppm) <u>NA</u>				Incompatibilities					
					MUC 1/2 Mask APR=TWA x 10= <u>2.5 mg/m³</u>				Acids, oxidizers, wate					
					MUC Full-Face APR=TWA x 10= <u>2.5 mg/m³</u>									
Checked by: Emmet F. Curtis					Date: 12/5/03					* Barium compounds. Pure barium may ignite in air.				

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Note: The recommended protective clothing materials assumes that potential for direct contact (by splashing, dust inhalation, or other means) with the contaminants exists. Professional judgment and knowledge of on-site hazards should be used in selecting PPE appropriate to the concentration of the contaminant (trace vs percentage) to which the individual is likely to be exposed.

APPENDIX D

CONTAMINANT FACT SHEET

CONTAMINANT FACT SHEET					HEALTH HAZARD DATA									
<p>Chemical Name: <u>Chromium</u></p> <p>CAS Number: <u>7440-47-3</u></p> <p>Synonyms: <u>Chrome, Chromium meta</u></p>					Color: <u>Blue-white to steel-gray</u>		Carcinogen: OSHA _____			Source	TWA (units)	STEL (units)	C (units)	
					Physical State: Solid <u>X</u>		IARC <u>X</u>							OSHA PELs
					Liquid _____		NTP <u>X</u>							
					Gas _____		ACGIH <u>X</u>							
					Odor: <u>odorless</u>		NIOSH <u>X</u>							
Odor Threshold: <u>NA</u>		Skin absorbable: yes ___ no <u>X</u>			ACGIH TLVs		0.01 mg/m ³							
Vapor Density: <u>NA</u>		Skin corrosive: yes ___ no <u>X</u>			NIOSH RELs		0.001 mg/m ³ (Cr VI)							
Ionization Potential (IP): <u>NA</u>		Signs/Symptoms of Acute Exposure: <u>Irritates eyes and skin</u>												
IDLH: <u>25 mg/m³ (CrIII)</u>														
AIR MONITORING					PERSONAL PROTECTIVE EQUIPMENT					FIRE/REACTIVITY DATA				
Type	Brand/Mode No.	Calibrations Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level	Recommended Protective Clothing Material:					Flash Point: <u>NA</u>				
Not Applicable (NA)					Suits: <u>Any chemical-resistant</u>					LEL/UEL: <u>NA / NA</u>				
					Gloves: <u>Any chemical-resistant</u>					Fire Extinguishing Media				
					Boots: <u>Any chemical-resistant</u>					Dry Chemical <u>X</u> Foam <u>X</u>				
										Water Spray <u>X</u> CO ₂ <u>X</u>				
					Service Limit Concentration (ppm) <u>NA</u>					Incompatibilities				
					MUC 1/2 Mask APR = TWA x 10 = <u>0.05 mg/m³</u>					Strong oxidizers, alkali:				
					MUC Full-Face APR = TWA x 10 = <u>0.05 mg/m³</u>									
Checked by: <u>Emmet F. Curtis</u>					Date: <u>12/5/03</u>									

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Note: The recommended protective clothing materials assumes that potential for direct contact (by splashing, dust inhalation, or other means) with the contaminants exists. Professional judgment and knowledge of on-site hazards should be used in selecting PPE appropriate to the concentration of the contaminant (trace vs percentage) to which the individual is likely to be exposed.

APPENDIX D
CONTAMINANT FACT SHEET

HEALTH HAZARD DATA							
<p align="center">CONTAMINANT FACT SHEET</p> <p>Chemical Name: <u>Copper</u></p> <p>CAS Number: <u>7440-50-8</u></p> <p>Synonyms: <u>Cu, copper metal dusts</u></p>	Color: <u>Reddish gold metallic</u>	Carcinogen: OSHA _____ IARC _____ NTP _____ ACGIH _____ NIOSH _____	Source	TWA (units)	STEL (units)	C (units)	
	Physical State: Solid <input checked="" type="checkbox"/> Liquid _____ Gas _____	Skin absorbable: <u>Yes</u>	Skin corrosive: <u>No</u>	OSHA PELs	1 mg/m ³		
	Odor: <u>NA</u>	Signs/Symptoms of Acute Exposure: <u>Fumes/dust may cause eye/upper respiratory irritation; may induce allergic contact dermatitis in susceptible individuals. Ingestion causes nausea, vomiting, abdominal pain, metallic taste, and diarrhea. Ingestion of large doses may cause stomach and intestine ulceration, jaundice, and kidney and liver damage.</u>	ACGIH TLVs	1 mg/m ³			
	Odor Threshold <u>NA</u> Vapor Density: <u>NA</u> Ionization Potential (IP): <u>NA</u> IDLH: <u>100 mg/m³</u>		NIOSH RELs	1 mg/m ³			
AIR MONITORING							
Type	Brand/Model No.	Calibration Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level			
Collection on a Mixed Cellulose Ester Filter (MCEF) 0.8 microns at a flow rate of 2 liters/minute until a maximum collection volume of 960 liters is reached. Analysis via AAS or ICP	NA	NA	NA	NA			
Dust meter **Action limit will be based on soil concentrations. Contact C. Sundquist for action limits	Any		N/A	**			
Checked by: _____ Date: _____							
PERSONAL PROTECTIVE EQUIPMENT							
Recommended Protective Clothing Materials:							
Suits <u>Tyvek, Polycoated Tyvkes</u>							
Gloves <u>Any chemical-resistant Gloves</u>							
Boots <u>Any chemical-resistant boots</u>							
Service Limit Concentration (ppm): _____							
MUC 1/2 Mask APR = TWA x 10 = <u>**10 mg/m³</u>							
MUC Full-Face APR = TWA x 50 = <u>**50 mg/m³</u>							
*If quantitative fit testing is conducted, otherwise, use protection factor of 10							
**Action limit will be based on soil concentrations. Contact C. Sundquist for action limits							
FIRE/REACTIVITY DATA							
Flash Point: <u>NA</u>							
LEL/UEL: <u>NA</u>							
Fire Extinguishing Media:							
Dry Chemical <u>X</u> Foam <u>X</u>							
Water Spray _____ CO ₂ <u>X</u>							
Note: <u>Do not allow molten copper to contact water</u>							
Incompatibilities:							
<u>Reacts violently with ammonium nitrate, bromates, chlorates, iodates, chloride, ethylene oxide, hydrazine mononitrate, hydrazoic acid, sodium azide, potassium oxide, acetylene gas and magnesium metal</u>							

APPENDIX D

CONTAMINANT FACT SHEET

<p>CONTAMINANT FACT SHEET</p> <p>Chemical Name: <u>Zinc</u></p> <p>CAS Number: <u>7440-66-6</u></p> <p>Synonyms: <u>Zn, zinc metal dusts</u></p>					HEALTH HAZARD DATA												
					Color: <u>Silver/bluish white metallic</u>								Carcinogen: OSHA _____				
					Physical State: Solid <u>X</u>								IARC _____				
					Liquid _____								NTP _____				
					Gas _____								ACGIH _____				
Odor: <u>NA</u>				NIOSH _____													
Odor Threshold <u>NA</u>				Skin absorbable: <u>Yes</u>													
Vapor Density: <u>NA</u>				Skin corrosive: <u>No</u>													
Ionization Potential (IP): <u>NA</u>				Signs/Symptoms of Acute Exposure:													
IDLH: <u>NA</u>				<u>Fumes/dust may cause eye/upper respiratory irritation; may cause acute lung damage/edema.</u>													
AIR MONITORING					PERSONAL PROTECTIVE EQUIPMENT					FIRE/REACTIVITY DATA							
Type	Brand/Model No.	Calibration Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level	<u>Recommended Protective Clothing Materials:</u>					Flash Point: <u>NA</u>							
Collection on a Mixed Cellulose Ester Filter (MCEF) 0.8 microns at a flow rate of 2 liters/minute until a maximum collection volume of 960 liters is reached. Analysis via AAS or ICP	NA	NA	NA	NA	Suits <u>Uncoated Tyveks</u>					LEL/UEL: <u>NA</u>							
					<u>Polycoated Tyveks</u>					Fire Extinguishing Media:							
Dust meter **Action limit will be based on soil concentrations. Contact C. Sundquist for action limits	Any		N/A	**	Gloves <u>Any Chemical resistant Gloves</u>					Dry Chemical <u>X</u> Foam _____							
					Boots <u>Any Chemical resistant Boots</u>					Water Spray _____ CO ₂ _____							
					Service Limit Concentration (ppm): _____					Note: <u>Powder is very flammable; reacts chemically with halon and CO₂ gas extinguishers</u>							
					MUC 1/2 Mask APR = TWA x 10 = NA					Incompatibilities:							
					MUC Full-Face APR = TWA x 50 = NA					<u>Incompatible with NH₄NO₃, barium oxide, Ba(NO₃)₂, Cadmium, CS₂, chlorates, Cl₂, CrO₃, (ethyl acetoacetate + tribromoneopentyl alcohol), F₂, hydrazine mononitrate, hydroxylamine, Pb(N₃)₂, (Mg + Ba(NO₃)₂ + BaO₂), MnCl₂, HNO₃, performic acid, KClO₃, KNO₃, K₂O₂, Selenium, NaClO₃, Na₂O₂, Sulfur, Te, water, (NH₄)₂S, As₂O₃, CS₂, CaCl₂, NaOH, chlorinated rubber, catalytic metals, halocarbons, o-nitroanisole, nitrobenzene, nonmetals, oxidants, paint primer base, pentacarbonyliron, transition metal halides, seleninyl bromide</u>							
					*If quantitative fit testing is conducted, otherwise, use protection factor of 10												
					**Action limit will be based on soil concentrations. Contact C. Sundquist for action limits												
Checked by: _____					Date: _____												

APPENDIX D

CONTAMINANT FACT SHEET

CONTAMINANT FACT SHEET					HEALTH HAZARD DATA									
<p>Chemical Name: <u>Iron (salts)</u></p> <p>CAS Number: <u></u></p> <p>Synonyms: <u>Ferric and Ferrous sulfate, nitrate and chloride</u></p>					Color: <u>Varies</u>		Carcinogen: OSHA <u> </u>			Source	TWA (units)	STEL (units)	C (units)	
					Physical State: Solid <u> X </u>		IARC <u> </u>							OSHA PEL
					Liquid <u> </u>		NTP <u> </u>			ACGIH TLVs	1 mg/m3			
					Gas <u> </u>		ACGIH <u> </u>							NIOSH RELs
					Odor: <u> NA </u>		NIOSH <u> </u>							
					Odor Threshold: <u> NA </u>		Skin absorbable: yes <u> </u> no <u> X </u>							
					Vapor Density: <u> NA </u>		Skin corrosive: yes <u> </u> no <u> X </u>							
					Ionization Potential (IP): <u> NA </u>		Signs/Symptoms of Acute Exposure							
					IDLH: <u> NA </u>		Skin and eye irritation, mucous membrane, abdominal pain, vomiting, diarrhea, possible liver damage							
AIR MONITORING					PERSONAL PROTECTIVE EQUIPMENT					FIRE/REACTIVITY DATA				
Type	Brand/Mode No.	Calibrations Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level	Recommended Protective Clothing Material:					Flash Point: <u> NA </u>				
Not Available					Suits: <u> Tyvek </u>					LEL/UEL: <u> NA / NA </u>				
					Gloves: <u> Nitrile </u>					Fire Extinguishing Media				
					Boots: <u> Butyl rubber </u>					Dry Chemical <u> X </u> Foam <u> X </u>				
										Water Spray <u> X </u> CO ₂ <u> X </u>				
					Service Limit Concentration (ppm) <u> NA </u>					Incompatibilities				
					MUC 1/2 Mask APR=TWA x 10= <u> 5 mg/m3 </u>					Varies				
					MUC Full-Face APR=TWA x 10= <u> 5 mg/m3 </u>									
Checked by: Emmet F. Curtis					Date: 12/16/03									

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Note: The recommended protective clothing materials assumes that potential for direct contact (by splashing, dust inhalation, or other means) with the contaminants exists. Professional judgment and knowledge of on-site hazards should be used in selecting PPE appropriate to the concentration of the contaminant (trace vs percentage) to which the individual is likely to be exposed.

APPENDIX D

CONTAMINANT FACT SHEET

HEALTH HAZARD DATA																																																																																																														
CONTAMINANT FACT SHEET Chemical Name: <u>Lead</u> CAS Number: <u>7439-92-1</u> Synonyms: <u>Lead Meta</u> <u>Plumbum</u>	Color:	<u>Gray</u>	Carcinogen: OSHA	<u> </u>																																																																																																										
	Physical State	Solid <u> X </u> Liquid <u> </u> Gas <u> </u>	IARC	<u> X </u>																																																																																																										
	Odor:	<u>N/A</u>	NTP	<u> </u>																																																																																																										
	Odor Threshold:	<u>N/A</u>	ACGIH	<u> X </u>																																																																																																										
	Vapor Density:	<u>N/A</u>	NIOSH	<u> </u>																																																																																																										
	Ionization Potential (IP):	<u>N/A</u>	Skin absorbable	yes <u> </u> no <u> X </u>																																																																																																										
IDLH:	<u>100 mg/m³</u>	Skin corrosive:	yes <u> </u> no <u> X </u>																																																																																																											
			Signs/Symptoms of Acute Exposure																																																																																																											
			<u>Weak, insomnia, facial pallor, anorexia</u>																																																																																																											
			<u>low weight, constipation, abdominal</u>																																																																																																											
			<u>pain, anemia, paralysis (wrist and ankle</u>																																																																																																											
			<u>kidney disease, eye irritant, hypotensive</u>																																																																																																											
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #e0e0e0;"> <th colspan="2" style="text-align: center;">AIR MONITORING</th> <th colspan="3" style="text-align: center;">PERSONAL PROTECTIVE EQUIPMENT</th> <th colspan="4" style="text-align: center;">FIRE/REACTIVITY DATA</th> </tr> </thead> <tbody> <tr> <td style="width: 15%;">Type</td> <td style="width: 15%;">Brand/Mode No.</td> <td style="width: 15%;">Calibrations Method/Media</td> <td style="width: 15%;">Relative Response or Conversion Factor</td> <td style="width: 10%;">Meter Specific Action Level</td> <td colspan="3" style="text-align: center;"><u>Recommended Protective Clothing Material:</u></td> <td colspan="2">Flash Point: <u> NA </u></td> </tr> <tr> <td rowspan="4" style="text-align: center; vertical-align: middle;">Not Applicable</td> <td></td> <td></td> <td></td> <td></td> <td>Suits</td> <td colspan="2"><u> Tyvek </u></td> <td colspan="2">LEL/UEL: <u> NA / NA </u></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>Gloves</td> <td colspan="2"><u> Nitrile, Viton </u></td> <td colspan="2">Fire Extinguishing Media</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td colspan="2"><u> </u></td> <td colspan="2">Dry Chemical <u> </u> Foam <u> </u></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>Boots</td> <td colspan="2"><u> Rubber </u></td> <td colspan="2">Water Spray <u> </u> CO₂ <u> </u></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td colspan="2"><u> </u></td> <td colspan="2"><u>Incompatibilities</u></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td colspan="2"><u> </u></td> <td colspan="2">Strong oxidizers <u> </u></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td colspan="2"><u> </u></td> <td colspan="2">Hydrogen Peroxide <u> </u></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td colspan="2"><u> </u></td> <td colspan="2">Acid <u> </u></td> </tr> <tr> <td colspan="5">Checked by: <u>Emmet F. Curtis</u> Date: <u>12/5/03</u></td> <td colspan="5" style="text-align: center;"> Service Limit Concentration (ppm) <u> NA </u> MUC 1/2 Mask APR = TWA x 10 = <u> 0.25 mg/m³ </u> MUC Full-Face APR = TWA x 10 = <u> 0.25 mg/m³ </u> </td> </tr> </tbody> </table>					AIR MONITORING		PERSONAL PROTECTIVE EQUIPMENT			FIRE/REACTIVITY DATA				Type	Brand/Mode No.	Calibrations Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level	<u>Recommended Protective Clothing Material:</u>			Flash Point: <u> NA </u>		Not Applicable					Suits	<u> Tyvek </u>		LEL/UEL: <u> NA / NA </u>						Gloves	<u> Nitrile, Viton </u>		Fire Extinguishing Media							<u> </u>		Dry Chemical <u> </u> Foam <u> </u>						Boots	<u> Rubber </u>		Water Spray <u> </u> CO ₂ <u> </u>								<u> </u>		<u>Incompatibilities</u>								<u> </u>		Strong oxidizers <u> </u>								<u> </u>		Hydrogen Peroxide <u> </u>								<u> </u>		Acid <u> </u>		Checked by: <u>Emmet F. Curtis</u> Date: <u>12/5/03</u>					Service Limit Concentration (ppm) <u> NA </u> MUC 1/2 Mask APR = TWA x 10 = <u> 0.25 mg/m³ </u> MUC Full-Face APR = TWA x 10 = <u> 0.25 mg/m³ </u>				
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APPENDIX D

CONTAMINANT FACT SHEET

CONTAMINANT FACT SHEET					HEALTH HAZARD DATA										
<p>Chemical Name: <u>Aroclors-General 1336-36-3</u></p> <p>CAS Number: <u>11097-69-1, 53469-21-9</u></p> <p>Synonyms: <u>Chlorodiphenyls</u></p> <p><u>Polychlorinated biphenyls (PCBs)</u></p>					Color: <u>Colorless to pale yellow</u>		Carcinogen: OSHA _____			Source	TWA (units)	STEL (units)	C (units)		
					Physical State: Solid <u>X (below 50° F)</u>		IARC <u>X</u>								
					Liquid <u>(Viscous)</u>		NTP <u>X</u>			OSHA PELs	0.5 mg/m ³ (1254)	ACGIH TLVs	0.5 mg/m ³ (1254)	NIOSH RELs	0.001 mg/m ³ (1254)
					Gas _____		ACGIH <u>X</u>								
Odor: <u>Hydrocarbon-like</u>		NIOSH <u>X</u>			Skin absorbable: yes <u>X</u> no _____										
Odor Threshold: <u>NA</u>		Skin corrosive: yes <u>X</u> no _____			Signs/Symptoms of Acute Exposure										
Vapor Density: <u>NA</u>		Irritant to eyes, chloracne, liver damage			_____										
Ionization Potential (IP): <u>Unknown</u>		_____			_____										
IDLH: <u>5 mg/m³</u>		_____			_____										
AIR MONITORING					PERSONAL PROTECTIVE EQUIPMENT					FIRE/REACTIVITY DATA					
Type	Brand/Mode No.	Calibrations Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level	Recommended Protective Clothing Material:					Flash Point: <u>NA</u>					
Dust Meter	Any	Factory	N/A	**	Suits: <u>Saranex, Butyl Rubber, Neoprene, Viton, Teflon</u>					LEL/UEL: <u>NA/NA</u>					
**Action limit will be based on soil concentrations. Contact C. Sundquist for action limits					Gloves: <u>Viton, Butyl Rubber, Teflon, Neoprene</u>					Fire Extinguishing Media					
					Boots: <u>Butyl Rubber, Neoprene</u>					Dry Chemical <u>X</u> Foam <u>X</u>					
					Service Limit Concentration (ppm) _____ **					Water Spray <u>X</u> CO ₂ <u>X</u>					
					MUC 1/2 Mask APR = TWA x 10 = _____ **					Incompatibilities					
					MUC Full-Face APR = TWA x 10 = _____ **					Strong oxidizers					
Checked by: <u>C. Sundquist</u>					Date: <u>9/12/09</u>					** Contact C. Sundquist					

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Note: The recommended protective clothing materials assumes that potential for direct contact (by splashing, dust inhalation, or other means) with the contaminants exists. Professional judgment and knowledge of on-site hazards should be used in selecting PPE appropriate to the concentration of the contaminant (trace vs percentage) to which the individual is likely to be exposed.

APPENDIX D

CONTAMINANT FACT SHEET

CONTAMINANT FACT SHEET Chemical Name: Selenium CAS Number: 7782-49-2 Synonyms: Elemental selenium, selenium alloy	HEALTH HAZARD DATA				Carcinogen: OSHA _____ IARC _____ NTP _____ ACGIH _____ NIOSH _____ Skin absorbabl Yes _____ No _____ Skin corrosive: Yes _____ No _____ Signs/Symptoms of Acute Exposure Irritates eyes, skin, nose, throat; visual disturbances; headache, chills, fever shortness breath, bronchitis, metallic taste in mouth, garlic breath, GI tract disturbance, skin burns. In animals: anemia, liver necrosis, kidney, spleen damage. _____				
	Color:	Red to grey _____				Source OSHA PELs ACGIH TLVs NIOSH RELs	TWA (units) mg/m3	STEL (units) mg/m3	C (units) mg/m3
	Physical State:	Solid <input checked="" type="checkbox"/> _____ Liquid _____ Gas _____							
	Odor:	Odorless _____							
Odor Threshold:	N/A _____			0.2					
Vapor Density:	N/A _____			0.2					
Vapor Pressure:	N/A _____			0.2					
Ionization Potential (IP):	N/A _____			0.2					
IDLH:	1 mg/m3 _____								

AIR MONITORING					PERSONAL PROTECTIVE EQUIPMENT			FIRE/REACTIVITY DATA		
Type	Brand/Model No.	Calibrations Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level	<u>Recommended Protective Clothing Materials</u> Suits _____ Any - Uncoated tyveks ok _____ Gloves _____ Any _____ Boots _____ any _____ _____ _____ Service Limit Concentration (ppm) _____ ** MUC 1/2 Mask APR = TWA x 10 = _____ ** MUC Full-Face APR = TWA x 10 = _____ **			Flash Point: _____ N/A LEL/UEL: _____ N/A <u>Fire Extinguishing Media:</u> Dry Chemical _____ Foam _____ Water Spray _____ CO ₂ _____ <u>Incompatibilities:</u> Acids, strong oxidizers, chromium trioxide potassium bromate, cadmium _____ _____ _____		
PID with 10.2 - 10.6 eV lamp	Any	100 ppm isobutyle		N/A						
Dust Meter		Factory		**						
**Action limit will be based on soil concentrations. Contact C. Sundquist for action limits										

Checked by: Cindy Sundquist	Date: 9/26/2008	** Contact C. Sundquist
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Note: The recommended protective clothing materials assumes that potential for direct contact (by splashing, dust inhalation, or other means) with the contaminants exists. Professional judgment and knowledge of on-site hazards should be used in selecting PPE appropriate to the concentration of the contaminant (trace vs percentage) to which the individual is likely to be exposed.

APPENDIX D

CONTAMINANT FACT SHEET

CONTAMINANT FACT SHEET Chemical Name: Silver CAS Number: 7440-22-4 Synonyms: Argentium, silver metal	HEALTH HAZARD DATA														
	Color:	white, lustrous			Carcinogen: OSHA _____ IARC _____ NTP _____ ACGIH _____ NIOSH _____	Skin absorbabl Yes _____ No <u>X</u> Skin corrosive: Yes _____ No <u>X</u>	Signs/Symptoms of Acute Exposure Blue-gray eyes, nasal septum, throat and skin. Irritant, ulceration of the skin GI tract disturbances	Source	TWA (units) mg/m3	STEL (units) mg/m3	C (units) mg/m3				
	Physical State:	Solid <u>X</u> Liquid _____ Gas _____						OSHA PELs	0.01						
	Odor:	Odorless						ACGIH TLVs	0.1						
Odor Threshold:	N/A			NIOSH RELs				0.01							
Vapor Density:	N/A														
Vapor Pressure:	N/A														
Ionization Potential (IP):	N/A														
IDLH:	10 mg/m3														

AIR MONITORING					PERSONAL PROTECTIVE EQUIPMENT					FIRE/REACTIVITY DATA				
Type	Brand/Model No.	Calibrations Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level	<u>Recommended Protective Clothing Materials</u>					Flash Point: <u>N/A</u>				
PID with 10.2 - 10.6 eV lamp	Any	100 ppm isobutyle		N/A	Suits	<u>Any - Uncoated Tyveks ok</u>				LEL/UEL: <u>N/A</u>				
Dust Meter		Factory		**	Gloves	<u>Any</u>				<u>Fire Extinguishing Media:</u> Dry Chemical _____ Foam _____ Water Spray _____ CO ₂ _____				
**Action limit will be based on soil concentrations. Contact C. Sundquist for action limits					Boots	<u>Any</u>				<u>Incompatibilities:</u> Acetylene, ammonia, hydrogen peroxide, bromoazide, chloride trifluoride, ethyleneimine, oxalic acid, tartaric acid				
					Service Limit Concentration (ppm) _____ **									
					MUC 1/2 Mask APR = TWA x 10 = _____ **									
					MUC Full-Face APR = TWA x 10 = _____ **									
Checked by: Cindy Sundquist					Date: 9/26/2008					** Contact C Sundquist				

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Note: The recommended protective clothing materials assumes that potential for direct contact (by splashing, dust inhalation, or other means) with the contaminants exists. Professional judgment and knowledge of on-site hazards should be used in selecting PPE appropriate to the concentration of the contaminant (trace vs percentage) to which the individual is likely to be exposed.

APPENDIX D

CONTAMINANT FACT SHEET

<p>CONTAMINANT FACT SHEET</p> <p>Chemical Name: <u>Zinc Oxide</u></p> <p>CAS Number: <u>1314-13-2</u></p> <p>Synonyms: <u>Zinc Peroxide</u></p>	HEALTH HAZARD DATA				PERSONAL PROTECTIVE EQUIPMENT				FIRE/REACTIVITY DATA									
	Color: <u>White</u>				Carcinogen: OSHA _____ IARC _____ NTP _____ ACGIH _____ NIOSH _____				Source		TWA (units) ppm		STEL (units) ppm		C (units) ppm			
	Physical State: Solid <u>X</u> Liquid _____ Gas _____				Skin absorbabl Yes _____ No <u>X</u> Skin corrosive: Yes _____ No <u>X</u>				OSHA PELs		5 mg/m ³							
	Odor: <u>Odorless</u>				Signs/Symptoms of Acute Exposure Metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough; lassitude, metallic taste in mouth; headache; blurred vision; lower back pain; vomiting; malaise; tight chest; dyspnea; rales, decreased pulmonary function _____				ACGIH TLVs		2 mg/m ³		10 mg/m ³					
	Odor Threshold: <u>N/A</u>				Vapor Density: <u>N/A</u> Vapor Pressure <u>0 mmHg (approx)</u> Ionization Potential (IP) <u>N/A</u>				NIOSH RELs		5 mg/m ³		10 mg/m ³					
IDLH: <u>500 mg/m³</u>																		
AIR MONITORING					PERSONAL PROTECTIVE EQUIPMENT					FIRE/REACTIVITY DATA								
Type	Brand/Model No.	Calibrations Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level	<u>Recommended Protective Clothing Materials</u> Suits <u>Uncoated Tyvek</u> _____ _____ Gloves <u>Any</u> _____ _____ Boots <u>Any</u> _____ _____ _____ Service Limit Concentration (ppm) _____ MUC 1/2 Mask APR = TWA x 10 = <u>20 mg/m³</u> MUC Full-Face APR = TWA x 10 = <u>20 mg/m³</u>					Flash Point: <u>N/A</u> LEL/UEL: <u>N/A</u> <u>Fire Extinguishing Media:</u> Dry Chemical _____ Foam _____ Water Spray _____ CO ₂ _____ <u>Incompatibilities:</u> Chlorinated rubber (at 419°F), water _____ _____ _____								
Dust meter	Any	Factory	N/A															
Checked by: _____					Date: _____													

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Note: The recommended protective clothing materials assumes that potential for direct contact (by splashing, dust inhalation, or other means) with the contaminants exists. Professional judgment and knowledge of on-site hazards should be used in selecting PPE appropriate to the concentration of the contaminant (trace vs percentage) to which the individual is likely to be exposed.

APPENDIX E

JOB HAZARD ANALYSIS PER TASK

JOB HAZARD ANALYSIS FORM**JHA No.:** JHA - NOVI - 001 - 11 - 01**Job Title:** Mobilization/Demobilization, Site Preparation**Date of Analysis:** 07/20/11**Job Location:** Honeywell Lake Linden-C&H Power Plant Site**Project Manager:** Dan Dyer

Applicable ES&H Procedures:

- 2.9.A - Hazardous Waste Operations and Emergency Response Program
- 2.9.B - Hearing Conservation Program
- 2.9.C - Respiratory Protection Program
- 2.9.D - Personal Protective Equipment Program
- 2.9.E - Hazard Communication Program
- 2.5.1 - Operation of Company Vehicles and Use of Personal Vehicles on Company Business
- 2.5.1 - Heavy Equipment
- 2.13.1 - Medical Surveillance

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Prepare for Site Visit	1A) N/A	1A) Prior to leaving for site <ul style="list-style-type: none"> ▪ Obtain and review HASP prior to site visit, if possible ▪ Determine PPE needs – bring required PPE to the site, if not otherwise being provided at the site (e.g., steel toed boots) ▪ Determine training and medical monitoring needs and ensure all required Health and Safety training and medical monitoring has been received and is current ▪ Ensure all workers are fit for duty (alert, well rested, and mentally and physically fit to perform work assignment) ▪ If respiratory protection is required/potentially required, ensure that training and fit-testing has occurred within the past year. ▪ Familiarize yourself with route to the site
	1B) Vehicle defects	1B) Inspect company owned/leased vehicle for defects such as: <ul style="list-style-type: none"> ▪ Flat tires ▪ Windshield wipers worn or torn ▪ Oil puddles under vehicle ▪ Headlights, brake lights, turn signals not working
	1C) Insufficient emergency equipment, unsecured loads	1C) Insufficient emergency equipment, unsecured loads <ul style="list-style-type: none"> ▪ Ensure vehicle has first aid kit and that all medications are current (if first aid kits are not provided at the site) ▪ Ensure vehicle is equipped with warning flashers and/or flares and that the warning flashers work ▪ Cell phones are recommended to call for help in the event of an emergency ▪ Vehicles carrying tools must have a safety cage in place. All tools must be properly secured ▪ Vehicles must be equipped with chocks if the vehicle is to be left running, unattended. ▪ Ensure sufficient gasoline is in the tank

CORPORATE ES&H PROCEDURE

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 OWNER: H.J. GORDON APPROVER: S. D. RIMA Page 2 of 13

Key Work Steps	Hazards/Potential Hazards	Safe Practices
2. Operating vehicles – general	2A) Collisions, unsafe driving conditions	2A) Drive Defensively! <ul style="list-style-type: none"> ▪ Seat belts must be used at all times when operating any vehicle on company business. ▪ Drive at safe speed for road conditions ▪ Maintain adequate following distance ▪ Pull over and stop if you have to look at a map ▪ Try to park so that you don't have to back up to leave. ▪ If backing in required, walk around vehicle to identify any hazards (especially low level hazards that may be difficult to see when in the vehicle) that might be present. Use a spotter if necessary
3. Driving to the jobsite	3A) Dusty, winding, narrow roads	3A) Dusty, winding, narrow roads <ul style="list-style-type: none"> ▪ Drive confidently and defensively at all times. ▪ Go slow around corners, occasionally clearing the windshield.
	3B) Rocky or one-lane roads	3B) Rocky or one-lane roads <ul style="list-style-type: none"> ▪ Stay clear of gullies and trenches, drive slowly over rocks. ▪ Yield right-of-way to oncoming vehicles---find a safe place to pull over.
	3C) Stormy weather, near confused tourists	3C) Stormy weather, near confused tourists <ul style="list-style-type: none"> ▪ Inquire about conditions before leaving the office. ▪ Be aware of oncoming storms. ▪ Drive to avoid accident situations created by the mistakes of others.
	3D) When angry or irritated	3D) When angry or irritated <ul style="list-style-type: none"> ▪ Attitude adjustment; change the subject or work out the problem before driving the vehicle. Let someone else drive.
	3E) Turning around on narrow roads	3E) Turning around on narrow roads <ul style="list-style-type: none"> ▪ Safely turn out with as much room as possible. ▪ Know what is ahead and behind the vehicle. ▪ Use a backer if available.
	3F) Sick or medicated	3F) Sick or medicated <ul style="list-style-type: none"> ▪ Let others on the crew know you do not feel well. ▪ Let someone else drive.
	3G) On wet or slimy roads	3G) On wet or slimy roads <ul style="list-style-type: none"> ▪ Drive slow and safe, wear seatbelts.
	3H) Animals on road	3H) Animals on road <ul style="list-style-type: none"> ▪ Drive slowly, watch for other animals nearby. ▪ Be alert for animals darting out of wooded areas
4. Gain permission to enter site	4A) Hostile landowner, livestock, pets	4A) Hostile landowner, livestock, pets <ul style="list-style-type: none"> ▪ Talk to land owner, be courteous and diplomatic ▪ Ensure all animals have been secured away from work area
5. Mobilization/ Demobilization of Equipment and Supplies	5A) Struck by Heavy Equipment/Vehicles	5A) Struck by heavy equipment <ul style="list-style-type: none"> ▪ Be aware of heavy equipment operations. ▪ Keep out of the swing radius of heavy equipment. ▪ Ground personnel in the vicinity of heavy equipment operations will be within the view of the operator at all times ▪ Employees shall wear a high visibility vest or T-shirt (reflective vest required if working at night). ▪ Ground personnel will be aware of the counterweight swing and maintain an adequate buffer zone. ▪ Ground personnel will not stand directly behind heavy equipment when it is in operation.

CORPORATE ES&H PROCEDURE

ISSUED: 1/23/06 EFFECTIVE: 1/24/06 ESH-2.9.1 Revision 2
 OWNER: H.J. GORDON APPROVER: S. D. RIMA Page 3 of 13

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	5B) Struck by Equipment/Supplies	5B) Struck by Equipment/Supplies <ul style="list-style-type: none"> ▪ Workers will maintain proper space around their work area, if someone enters it, stop work. ▪ When entering another worker's work space, give a verbal warning so they know you are there.
	5C) Overexertion Unloading/Loading Supplies	5C) Overexertion Unloading/Loading Supplies <ul style="list-style-type: none"> ▪ Train workers on proper body mechanics, do not bend or twist at the waist while exerting force or lifting. ▪ Tightly secure all loads to the truck bed to avoid load shifting while in transit.
	5D) Caught in/on/between	5D) Caught in/on/between <ul style="list-style-type: none"> ▪ Do not place yourself between two vehicles or between a vehicle and a fixed object.
	5E) Slip/Trip/Fall	5E) 1E). Slip/Trip/Fall <ul style="list-style-type: none"> ▪ Mark all holes and low spots in area with banner tape. Instruct personnel to avoid these areas. ▪ Drivers will maintain 3 point contact when mounting/dismounting vehicles/equipment. ▪ Drivers will check surface before stepping, not jumping down.
	5F) Vehicle Incident	5F) Vehicle accident <ul style="list-style-type: none"> ▪ Employees should follow Mactec vehicle operation policy and be aware of all stationary and mobile vehicles.
6. Site Preparation	6A) Slip/Trip/Fall	6A) Slip/Trip/Fall <ul style="list-style-type: none"> ▪ Mark all holes and low spots in area with banner tape. Instruct personnel to avoid these areas
	6B) Overexertion	6B) Overexertion <ul style="list-style-type: none"> ▪ Workers will be trained in the proper method of lifting items. ▪ Do not bend and twist at the waist while lifting or exerting force.
	6C) Struck by Equipment/Supplies	6C) Struck by Equipment/Supplies <ul style="list-style-type: none"> ▪ Workers will maintain proper space around their work area, if someone enters it, stop work. ▪ When entering another worker's work space, give a verbal warning so they know you are there.
7. Driving back from the jobsite	8A) See hazards listed under item #3	8A) See safe work practices under item #3

CORPORATE ES&H PROCEDURE

ISSUED: 1/23/06 EFFECTIVE: 1/24/06 ESH-2.9.1 Revision 2
 OWNER: H.J. GORDON APPROVER: S. D. RIMA Page 4 of 13

Identify Hazards and PPE

Complete the checklists for hazard identification and PPE requirements. Information from the RA and applicable permits are included in this section.

Standard Hazards							
<input type="checkbox"/> Falling Objects	<input checked="" type="checkbox"/> Slips and trips	<input type="checkbox"/> Pinch points	<input type="checkbox"/> Rotating equipment				
<input checked="" type="checkbox"/> Falls	<input type="checkbox"/> Power equipment/tools	<input type="checkbox"/> Elevated work surfaces	<input type="checkbox"/> _____				
Eye Hazards							
<input checked="" type="checkbox"/> Particulates	<input type="checkbox"/> Liquid splashes	<input type="checkbox"/> Welding Arc	<input type="checkbox"/> _____				
Hearing Hazards							
<input type="checkbox"/> None	<input type="checkbox"/> Impact noise	<input type="checkbox"/> High frequency noise	<input checked="" type="checkbox"/> High ambient noise				
Respiratory Hazards							
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Dust/particulates	<input type="checkbox"/> Organic Vapors	<input type="checkbox"/> Acid Gases	<input type="checkbox"/> Radon	<input type="checkbox"/> Asbestos	<input type="checkbox"/> Be, Hg, Cr, Pb	
<input type="checkbox"/> Oxygen deficient	<input type="checkbox"/> Welding fumes	<input type="checkbox"/> Aerosols/Particulates	<input type="checkbox"/> _____				
Chemical Hazards							
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Organic solvents	<input type="checkbox"/> Reactive metals	<input type="checkbox"/> PCBs				
<input type="checkbox"/> Acids / bases	<input type="checkbox"/> Oxidizers	<input type="checkbox"/> Volatiles / Semi-volatiles	<input type="checkbox"/> _____				
Environmental Hazards							
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Temperature extremes: <input checked="" type="checkbox"/> Cold <input checked="" type="checkbox"/> Heat	<input type="checkbox"/> Wet location	<input type="checkbox"/> Explosive vapors	<input type="checkbox"/> Confined space	<input type="checkbox"/> Engulfment Hazard		
<input checked="" type="checkbox"/> Bio hazards (poisonous plants, insects, snakes, bird/mouse droppings, fungus, etc.)			<input type="checkbox"/> _____				
Electrical Hazards							
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Overhead utilities	<input type="checkbox"/> Underground utilities	<input type="checkbox"/> Hidden utilities	<input type="checkbox"/> Energized equip/circuits	<input type="checkbox"/> Wet location		
Fire Hazards							
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cutting, welding, or grinding generated sparks or heat sources	<input type="checkbox"/> Flammable materials present	<input type="checkbox"/> Oxygen enriched location				
Ergonomic Hazards							
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Lifting	<input checked="" type="checkbox"/> Bending	<input type="checkbox"/> Twisting	<input checked="" type="checkbox"/> Pulling/tugging	<input type="checkbox"/> Repetitive motion		
Computer Use in the:	<input checked="" type="checkbox"/> Office	<input type="checkbox"/> Field	<input type="checkbox"/> _____				
Radiological Hazards							
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Loose contamination	<input type="checkbox"/> Fixed Contamination	<input type="checkbox"/> Airborne contamination	<input type="checkbox"/> Radiation	<input type="checkbox"/> Radon		
<input type="checkbox"/> Alpha	<input type="checkbox"/> Beta	<input type="checkbox"/> Gamma/X-rays	<input type="checkbox"/> Neutron	<input type="checkbox"/> EMF	<input type="checkbox"/> Criticality	<input type="checkbox"/> Tritium	<input type="checkbox"/> TRU
<input type="checkbox"/> Depleted Uranium	<input type="checkbox"/> Enriched Uranium	<input type="checkbox"/> _____		<input type="checkbox"/> _____			
Other Hazards							
<input type="checkbox"/>							

Completed by: Douglas Saigh Date: 07/20/11

CORPORATE ES&H PROCEDURE

ISSUED: 1/23/06 EFFECTIVE: 1/24/06 ESH-2.9.1 Revision 2
 OWNER: H.J. GORDON APPROVER: S. D. RIMA Page 5 of 13

PPE and Monitoring Requirements

Standard PPE					
<input checked="" type="checkbox"/> Hard Hat	<input checked="" type="checkbox"/> Safety shoes	<input checked="" type="checkbox"/> Safety glasses	<input checked="" type="checkbox"/> Boot Covers	<input type="checkbox"/> Rubber Boots	<input checked="" type="checkbox"/> High Visibility Vest
Eye and Face Protection					
<input type="checkbox"/> Welding glasses	<input type="checkbox"/> Welding helmet	<input type="checkbox"/> Face shield	<input type="checkbox"/> Chemical goggles	<input type="checkbox"/> Welding screens	
Hearing Protection					
<input checked="" type="checkbox"/> Ear plugs	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Ear plugs and muffs	<input type="checkbox"/> Other _____		
Respiratory Protection					
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Upgrade Only	<input type="checkbox"/> Full Face APR	<input type="checkbox"/> Half Face APR	Cart. Type _____	<input type="checkbox"/> PAPR
<input type="checkbox"/> Airline respirator	<input type="checkbox"/> SCBA	<input type="checkbox"/> Dust mask	<input type="checkbox"/> _____		
Protective Clothing					
<input type="checkbox"/> Tyvek® coveralls	<input type="checkbox"/> Poly-coated Tyvek® Coveralls	<input type="checkbox"/> Saranex® Coveralls	<input type="checkbox"/> Fully encapsulating suit		
<input type="checkbox"/> Cotton coveralls	<input type="checkbox"/> Modesty Clothing	<input type="checkbox"/> Fire resistant clothing	<input type="checkbox"/> Other _____		
Hand Protection					
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cotton gloves	<input type="checkbox"/> Leather gloves	<input type="checkbox"/> Cut-resistant gloves	<input type="checkbox"/> Glove liners	
Outer Gloves					
<input type="checkbox"/> Nitrile	<input type="checkbox"/> Viton®	<input type="checkbox"/> Butyl	<input type="checkbox"/> Neoprene	<input type="checkbox"/> Other _____	
Inner Gloves					
<input type="checkbox"/> Nitrile	<input type="checkbox"/> Vinyl	<input type="checkbox"/> Latex	<input type="checkbox"/> Other _____		
Monitoring Requirements					
<input type="checkbox"/> Oxygen	<input type="checkbox"/> Flammable gases/vapors	<input type="checkbox"/> Toxic Gas/vapors	<input type="checkbox"/> Hydrogen Sulfide	Carbon Monoxide	
<input type="checkbox"/> Asbestos	<input type="checkbox"/> Full time IH coverage	<input type="checkbox"/> Part time IH coverage	<input type="checkbox"/> Be, Hg, Cr, Pb		
<input type="checkbox"/> Metals Specify: _____					
<input type="checkbox"/> Organic Vapors Specify: _____					
<input type="checkbox"/> None	<input type="checkbox"/> TLD required	<input type="checkbox"/> CAM	<input type="checkbox"/> Radon		
<input type="checkbox"/> Full time RCT coverage	<input type="checkbox"/> Part time RCT coverage	<input type="checkbox"/> Radioactive air particulates	<input type="checkbox"/> Other _____		
<input type="checkbox"/> Other ____			<input type="checkbox"/> Other _____		

PPE and monitoring requirements completed by: Douglas Saigh Date: 07/20/11

CORPORATE ES&H PROCEDURE

ISSUED: 1/23/06 EFFECTIVE: 1/24/06 ESH-2.9.1 Revision 2
 OWNER: H.J. GORDON APPROVER: S. D. RIMA Page 6 of 13

JOB HAZARD ANALYSIS FORM

JHA No.: JHA - NOVI - 002 - 11 - 01

Job Title: Field Work – General

Date of Analysis: 07/20/11

Job Location: Honeywell Lake Linden-C&H Power Plant Site

Project Manager: Dan Dyer

- Applicable ES&H Procedures:
- 2.9.A - Hazardous Waste Operations and Emergency Response Program
 - 2.9.B - Hearing Conservation Program
 - 2.9.C - Respiratory Protection Program
 - 2.9.D - Personal Protective Equipment Program
 - 2.9.E - Hazard Communication Program
 - 2.5.1 - Operation of Company Vehicles and Use of Personal Vehicles on Company Business
 - 2.5.1 - Heavy Equipment
 - 2.9.7 - Overhead and Underground Utilities
 - 2.9.8 - Permit-Required Confined Space
 - 2.9.16 - Thermal Stress
 - 2.9.19 - Electrical Safety
 - 2.9.20 - Lockout / Tagout
 - 2.9.21 - Power and Hand Tools
 - 2.13.1 - Medical Surveillance

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Mobilization/ Demobilization and Site Preparation	1A) See Mobilization / Demobilization and Site Preparation JHA	1A) See Mobilization/Demobilization and Site Preparation JHA
2. Communication	2A) Safety, crew unity	2A) Talk to each other. <ul style="list-style-type: none"> ▪ Log all workers and visitor on and off the site. ▪ Let other crewmembers know when you see a hazard. ▪ Avoid working near known hazards. ▪ Always know the whereabouts of fellow crewmembers. ▪ Carry a radio and spare batteries or cell phone ▪ Review Emergency Evacuation Procedures (see below).
3. Walking and working in the field	3A) Falling down, twisted ankles and knees, poor footing	3A) Always watch your footing. <ul style="list-style-type: none"> ▪ Horseplay is strictly prohibited ▪ Slow down and use extra caution around logs, rocks, and animal holes. ▪ Extremely steep slopes (>50%) can be hazardous under wet or dry conditions; consider an alternate route. ▪ Wear laced boots with a minimum 8" high upper and non-skid Vibram-type soles for ankle support and traction.
	3B) Falling objects	3B) Protect head against falling objects. <ul style="list-style-type: none"> ▪ Wear your hardhat for protection from falling limbs and pinecones, and from tools and equipment carried by other crewmembers. ▪ Stay out of the woods during extremely high winds.

CORPORATE ES&H PROCEDURE

ISSUED: 1/23/06 EFFECTIVE: 1/24/06 ESH-2.9.1 Revision 2
 OWNER: H.J. GORDON APPROVER: S. D. RIMA Page 7 of 13

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3C) Chemical/Toxicological Hazards	3C) Chemical/Toxicological Hazards <ul style="list-style-type: none"> ▪ See HASP for appropriate level of PPE ▪ Use monitoring equipment, as outlined in HASP, to monitor breathing zone ▪ Read MSDSs for all chemicals brought to the site ▪ Be familiar with hazards associated with site contaminants. ▪ Ensure that all containers are properly labelled ▪ Decon thoroughly prior to consumption of food, beverage or tobacco.
	3D) Damage to eyes	3D) Protect eyes: <ul style="list-style-type: none"> ▪ Watch where you walk, especially around trees and brush with limbs sticking out. ▪ Exercise caution when clearing limbs from tree trunks. Advise wearing eye protection. ▪ Ultraviolet light from the sun can be damaging to the eyes; look for sunglasses that specify significant protection from UV-A and UV-B radiation. If safety glasses require, use one's with tinted lenses
	3E) Bee and wasp stings	3E) See JHA for Insect Stings and Bites
	3F) Ticks and infected mosquitos	3F) See JHA for Insect Stings and Bites
	3G) Wild Animals	3G) Wild Animals <ul style="list-style-type: none"> ▪ Avoid physical contact with wild animals ▪ Do not threaten and/or corner animals ▪ Make noise to get the animal to retreat. ▪ Stay in or return to vehicle/equipment if in danger
	3H) Contact with poisonous plants or the oil from those plants:	3H) Contact with poisonous plants or the oil from those plants: <ul style="list-style-type: none"> ▪ Look for signs of poisonous plants and avoid. ▪ Ensure all field workers can identify the plants. Mark identified poisonous plants with spray paint if working at a fixed location. ▪ Do not allow plant to touch any part of your body/clothing. ▪ Wear PPE as described in the HASP and wear Tyveks, gloves and boot covers if contact with plant is likely ▪ Always wash gloves before removing them. ▪ Discard PPE in accordance with the HASP. ▪ Use commercially available products such as Ivy Block or Ivy Wash as appropriate. ▪ See the JHA for Poisonous Plants
		<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>POISON IVY (<i>Rhus toxicodendron</i> L.)</p> </div> <div style="text-align: center;">  <p>POISON OAK (<i>Rhus diversiloba</i>)</p> </div> <div style="text-align: center;">  <p>POISON SUMAC (<i>Rhus toxicodendron vernis</i>)</p> </div> </div>

CORPORATE ES&H PROCEDURE

ISSUED: 1/23/06 EFFECTIVE: 1/24/06 ESH-2.9.1 Revision 2
 OWNER: H.J. GORDON APPROVER: S. D. RIMA Page 8 of 13

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3I) Back Injuries	3I) Back Injuries <ul style="list-style-type: none"> ▪ Site personnel will be instructed on proper lifting techniques. ▪ Mechanical devices should be used to reduce manual handling of materials. ▪ Split heavy loads in to smaller loads ▪ Team lifting should be utilized if mechanical devices are not available. ▪ Make sure that path is clear prior to lift.
	3J) Shoveling	3J) Shoveling <ul style="list-style-type: none"> ▪ Select the proper shovel for the task. A long handled, flat bladed shovel is recommend for loose material ▪ Inspect the handle for splinters and/or cracks ▪ Ensure that the blade is securely attached to the handle ▪ Never be more than 15 inches from the material you are shoveling ▪ Stand with your feet about hip width for balance and keep the shovel close to your body. ▪ Bend from the knees (not the back) and tighten your stomach muscles as you lift. ▪ Avoid twisting movements. If you need to move the snow to one side reposition your feet to face the direction the snow will be going. ▪ Avoid lifting large shoveling too much at once. When lifting heavy material, pick up less to reduce the weight lifted. ▪ Pace yourself to avoid getting out of breath and becoming fatigued too soon. ▪ Be alert for signs of stress such as pain, numbness, burning and tingling. Stop immediately if you feel any of these symptoms.
	3K) Slips/Trips/Falls	3K) Slips/Trips/Falls <ul style="list-style-type: none"> ▪ Maintain work areas safe and orderly; unloading areas should be on even terrain; mark or repair possible tripping hazards. ▪ Site SHSO inspect the entire work area to identify and mark hazards. ▪ Maintain three points of contact when climbing ladders or onto/off of equipment
	3L) Overhead Hazards	3L) Overhead Hazards <ul style="list-style-type: none"> ▪ Personnel will be required to wear hard hats that meet ANSI Standard Z89.1. ▪ All ground personnel will stay clear of suspended loads. ▪ All equipment will be provided with guards, canopies or grills to protect the operator from falling or flying objects. ▪ All overhead hazards will be identified prior to commencing work operations.
	3M) Dropped Objects	3M) Dropped Objects <ul style="list-style-type: none"> ▪ Steel toe boots meeting ANSI Standard Z41 will be worn.
	3N) Noise	3N) Noise <ul style="list-style-type: none"> ▪ Hearing protection will be worn with a noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs); all equipment will be equipped with manufacturer's required mufflers. Hearing protection shall be worn by all personnel working in or near heavy equipment.
	3O) Eye Injuries	3O) Eye Injuries <ul style="list-style-type: none"> ▪ Safety glasses meeting ANSI Standard Z87 will be worn.

CORPORATE ES&H PROCEDURE

ISSUED: 1/23/06 EFFECTIVE: 1/24/06 ESH-2.9.1 Revision 2
 OWNER: H.J. GORDON APPROVER: S. D. RIMA Page 9 of 13

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3P) Heavy Equipment (overhead hazards, spills, struck by or against)	3P) Heavy Equipment <ul style="list-style-type: none"> ▪ All operators will be trained and qualified to operate equipment ▪ Equipment will have seat belts. ▪ Operators will wear seat belts when operating equipment. ▪ Do not operate equipment on grades that exceed manufacturer's recommendations. ▪ Equipment will have guards, canopies or grills to protect from flying objects. ▪ Ground personnel will stay clear of all suspended loads. ▪ Personnel are prohibited from riding on the buckets, or elsewhere on the equipment except for designated seats with proper seat belts or lifts specifically designed to carry workers. ▪ Ground personnel will wear high visibility vests ▪ Spill and absorbent materials will be readily available. ▪ Drip pans, polyethylene sheeting or other means will be used for secondary containment. ▪ Ground personnel will stay out of the swing radius of excavators. ▪ Eye contact with operators will be made before approaching equipment. ▪ Operator will acknowledge eye contact by removing his hands from the controls. ▪ Equipment will not be approached on blind sides. ▪ All equipment will be equipped with backup alarms and use spotters when significant physical movement of equipment occurs on-site, (i.e., other than in place excavation or truck loading). ▪ Inspect rigging prior to each use.
	3Q) Struck by vehicle/equipment	3Q) Struck by vehicle/equipment <ul style="list-style-type: none"> ▪ Be aware of heavy equipment operations. ▪ Keep out of the swing radius of heavy equipment. ▪ Ground personnel in the vicinity of vehicles or heavy equipment operations will be within the view of the operator at all times. ▪ Ground personnel will be aware of the counterweight swing and maintain an adequate buffer zone. ▪ Ground personnel will not stand directly behind heavy equipment when it is in operation. ▪ Drivers will keep workers on foot in their vision at all times, if you lose sight of someone, Stop! ▪ Spotters will be used when backing up trucks and heavy equipment and when moving equipment. ▪ High visibility vests will be worn when workers are exposed to vehicular traffic at the site or on public roads.
	3R) Struck/cut by tools	3R) Struck/cut by tools <ul style="list-style-type: none"> ▪ Cut resistant work gloves will be worn when dealing with sharp objects. ▪ All hand and power tools will be maintained in safe condition. ▪ Do not drop or throw tools. Tools shall be placed on the ground or worksurface or handed to another employee in a safe manner. ▪ Guards will be kept in place while using hand and power tools.
	3S) Caught in/on/between	3S) Caught in/on/between <ul style="list-style-type: none"> ▪ Workers will not position themselves between equipment and a stationary object. ▪ Workers will not wear long hair down (place in pony-tail and tuck into shirt) or jewelry if working with tools/machinery.

CORPORATE ES&H PROCEDURE

ISSUED: 1/23/06 EFFECTIVE: 1/24/06 ESH-2.9.1 Revision 2
 OWNER: H.J. GORDON APPROVER: S. D. RIMA Page 10 of 13

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3T) Contact with Electricity/Lightning	3T) Contact with Electricity/Lighting <ul style="list-style-type: none"> ▪ All electrical tools and equipment will be equipped with GFCI. ▪ Electrical extension cords will be of the "Hard" or "Extra Hard" service type. ▪ All extension cords shall have a three-blade grounding plug. ▪ Personnel shall not use extension cords with damaged outer covers, exposed inner wires, or splices. ▪ Electrical cords shall not be laid across roads where vehicular traffic may damage the cord without appropriate guarding. ▪ All electrical work will be conducted by a licensed electrician. ▪ All equipment will be locked out and tagged out and rendered in a zero energy state prior to commencing any operation that may expose workers to electrical, mechanical, hydraulic, etc. hazards. ▪ All utilities will be marked prior to excavation activities. ▪ All equipment will stay a minimum of 10 feet from overhead energized electrical lines (50 kV). This distance will increase by 4 inches for each 10 kV above 50 kV. Rule of Thumb: Stay 10 feet away from all overhead powerlines known to be 50 kV or less and 35 feet from all others.) ▪ The SHSO shall halt outdoor site operations whenever lightning is visible, outdoor work will not resume until 30 minutes after the last sighting of lightning.
	3U) Equipment failure	3U) Equipment failure <ul style="list-style-type: none"> ▪ All equipment will be inspected before use. If any safety problems are noted, the equipment should be tagged and removed from service until repaired or replaced.
	3V) Hand & power tool usage.	3V) Hand & power tool usage <ul style="list-style-type: none"> ▪ Daily inspections will be performed. ▪ Ensure guards are in place and are in good condition. ▪ Remove broken or damaged tools from service. ▪ Use the tool for its intended purpose. ▪ Use in accordance with manufacturers instructions. ▪ No tampering with electrical equipment is allowed (e.g., splicing cords, cutting the grounding prong off plug, etc.) ▪ See JHA for Power Tool Use - Electrical and Power Tool Use - Gasoline
	3W) Fire Protection	3W) Fire Protection <ul style="list-style-type: none"> ▪ Ensure that adequate number and type of fire extinguishers are present at the site ▪ Inspect fire extinguishers on a monthly basis – document ▪ All employees who are expected to use fire extinguishers will have received training on an annual basis. ▪ Obey no-smoking policy ▪ Open fires are prohibited ▪ Maintain good housekeeping. Keep rubbish and combustibles to a minimum. ▪ Keep flammable liquids in small containers with lids closed or a safety can. ▪ When dispensing flammable liquids, do in well vented area and bond and ground containers.
	3X) Confined Space Entry	3X) Confined Space Entry <ul style="list-style-type: none"> ▪ See JHA for Confined Space Entry

CORPORATE ES&H PROCEDURE

ISSUED: 1/23/06 EFFECTIVE: 1/24/06 ESH-2.9.1 Revision 2
 OWNER: H.J. GORDON APPROVER: S. D. RIMA Page 11 of 13

Key Work Steps	Hazards/Potential Hazards	Safe Practices
4. Environmental health considerations	4A) Heat Stress	4A) Take precautions to prevent heat stress <ul style="list-style-type: none"> ▪ Remain constantly aware of the four basic factors that determine the degree of heat stress (air temperature, humidity, air movement, and heat radiation) relative to the surrounding work environmental heat load. ▪ Know the signs and symptoms of heat exhaustion, heat cramps, and heat stroke. Heat stroke is a true medical emergency requiring immediate emergency response action. <p>NOTE: The severity of the effects of a given environmental heat stress is decreased by reducing the work load, increasing the frequency and/or duration of rest periods, and by introducing measures which will protect employees from hot environments.</p> <ul style="list-style-type: none"> ▪ Maintain adequate water intake by drinking water periodically in small amounts throughout the day (flavoring water with citrus flavors or extracts enhances palatability). ▪ Allow approximately 2 weeks with progressive degrees of heat exposure and physical exertion for substantial acclimatization. ▪ Acclimatization is necessary regardless of an employee's physical condition (the better one's physical condition, the quicker the acclimatization). Tailor the work schedule to fit the climate, the physical condition of employees, and mission requirements. <ul style="list-style-type: none"> ▪ A reduction of work load markedly decreases total heat stress. ▪ Lessen work load and/or duration of physical exertion the first days of heat exposure to allow gradual acclimatization. ▪ Alternate work and rest periods. More severe conditions may require longer rest periods and electrolyte fluid replacement.
	4B) Wet Bulb Globe Temperature (WBGT) Index	4B) WBGT <ul style="list-style-type: none"> ▪ Curtail or suspend physical work when conditions are extremely severe (see attached Heat Stress Index). ▪ Compute a Wet Bulb Globe Temperature Index to determine the level of physical activity (take WBGT index measurements in a location that is similar or closely approximates the environment to which employees will be exposed).
		WBGT THRESHOLD VALUES FOR INSTITUTING PREVENTIVE MEASURES
		80-90 degrees F Fatigue possible with prolonged exposure and physical activity. 90-105 degrees F Heat exhaustion and heat stroke possible with prolonged exposure and physical activity. 105-130 degrees F Heat exhaustion and heat stroke are likely with prolonged heat exposure and physical activity.
	4C) Cold Extremes	4C) Take precautions to prevent cold stress injuries <ul style="list-style-type: none"> ▪ Cover all exposed skin and be aware of frostbite. While cold air will not freeze the tissues of the lungs, slow down and use a mask or scarf to minimize the effect of cold air on air passages. ▪ Dress in layers with wicking garments (those that carry moisture away from the body – e.g., cotton) and a weatherproof slicker. A wool outer garment is recommended. ▪ Take layers off as you heat up; put them on as you cool down. ▪ Wear head protection that provides adequate insulation and protects the ears. ▪ Maintain your energy level. Avoid exhaustion and over-exertion which causes sweating, dampens clothing, and accelerates loss of body heat and increases the potential for hypothermia. ▪ Acclimate to the cold climate to minimize discomfort. ▪ Maintain adequate water/fluid intake to avoid dehydration.

CORPORATE ES&H PROCEDURE

ISSUED: 1/23/06 EFFECTIVE: 1/24/06 ESH-2.9.1 Revision 2
 OWNER: H.J. GORDON APPROVER: S. D. RIMA Page 12 of 13

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	4D) Wind	4D) Effects of the wind <ul style="list-style-type: none"> ▪ Wind chill greatly affects heat loss (see attached Wind Chill Index). ▪ Avoid marking in old, defective timber, especially hardwoods, during periods of high winds due to snag hazards.
	4E) Thunderstorms	4E) Thunderstorms <ul style="list-style-type: none"> ▪ Monitor weather channels to determine if electrical storms are forecasted. ▪ Plan ahead and identify safe locations to be in the event of a storm. (e.g., sturdy building, vehicle, etc.) ▪ Suspend all field work at the first sound of thunder. You should be in a safe place when the time between the lightning and thunder is less than 30 seconds. ▪ Only return to work 30 minutes after the after the last strike or sound of thunder

Relative Humidity (%) furnished by National Weather Service Gray, ME

Air Temperature

°F	40	45	50	55	60	65	70	75	80	85	90	95	100
110	136												
108	130	137											
106	124	130	137										
104	119	124	131	137									
102	114	119	124	130	137								
100	109	114	118	124	129	136							
98	105	109	113	117	123	128	134						
96	101	104	108	112	116	121	126	132					
94	97	100	103	106	110	114	119	124	129	135			
92	94	96	99	101	105	108	112	116	121	126	131		
90	91	93	95	97	100	103	106	109	113	117	122	127	132
88	88	89	91	93	95	98	100	103	106	110	113	117	121
86	85	87	88	89	91	93	95	97	100	102	105	108	112
84	83	84	85	86	88	89	90	92	94	96	98	100	103
82	81	82	83	84	84	85	86	88	89	90	91	93	95
80	80	80	81	81	82	82	83	84	84	85	86	86	87

Heat Index
(Apparent
Temperature)

**With Prolonged Exposure
and/or Physical Activity**

Extreme Danger
Heat stroke or sunstroke highly likely
Danger
Sunstroke, muscle cramps, and/or heat exhaustion likely
Extreme Caution
Sunstroke, muscle cramps, and/or heat exhaustion possible
Caution
Fatigue possible



Wind Chill Chart



Temperature (°F)

Wind (mph)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5		36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10		34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15		32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20		30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25		29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30		28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35		28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40		27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45		26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50		26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55		25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60		25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times

30 minutes

10 minutes

5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

CORPORATE ES&H PROCEDURE

ISSUED: 1/23/06 EFFECTIVE: 1/24/06 ESH-2.9.1 Revision 2
 OWNER: H.J. GORDON APPROVER: S. D. RIMA Page 1 of 6

Identify Hazards and PPE

Complete the checklists for hazard identification and PPE requirements. Information from the RA and applicable permits are included in this section.

Standard Hazards						
<input checked="" type="checkbox"/> Falling Objects	<input checked="" type="checkbox"/> Slips and trips	<input type="checkbox"/> Pinch points	<input type="checkbox"/> Rotating equipment			
<input type="checkbox"/> Falls	<input checked="" type="checkbox"/> Power equipment/tools	<input checked="" type="checkbox"/> Elevated work surfaces	<input type="checkbox"/> _____			
Eye Hazards						
<input checked="" type="checkbox"/> Particulates	<input type="checkbox"/> Liquid splashes	<input type="checkbox"/> Welding Arc	<input type="checkbox"/> _____			
Hearing Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Impact noise	<input type="checkbox"/> High frequency noise	<input checked="" type="checkbox"/> High ambient noise			
Respiratory Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Dust/particulates	<input type="checkbox"/> Organic Vapors	<input type="checkbox"/> Acid Gases	<input type="checkbox"/> Radon	<input type="checkbox"/> Asbestos	<input type="checkbox"/> Be, Hg, Cr, Pb
<input type="checkbox"/> Oxygen deficient	<input type="checkbox"/> Welding fumes	<input type="checkbox"/> Aerosols/Particulates		<input type="checkbox"/> _____		
Chemical Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Organic solvents	<input type="checkbox"/> Reactive metals	<input checked="" type="checkbox"/> PCBs			
<input type="checkbox"/> Acids / bases	<input type="checkbox"/> Oxidizers	<input type="checkbox"/> Volatiles / Semi-volatiles	<input type="checkbox"/> _____			
Environmental Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Temperature extremes: <input checked="" type="checkbox"/> Cold <input checked="" type="checkbox"/> Heat	<input checked="" type="checkbox"/> Wet location	<input type="checkbox"/> Explosive vapors	<input type="checkbox"/> Confined space	<input type="checkbox"/> Engulfment Hazard	
<input checked="" type="checkbox"/> Bio hazards (poisonous plants, insects, animals, fungus, etc.)			<input type="checkbox"/> _____			
Electrical Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Overhead utilities	<input checked="" type="checkbox"/> Underground utilities	<input type="checkbox"/> Hidden utilities	<input checked="" type="checkbox"/> Energized equip/circuits	<input checked="" type="checkbox"/> Wet location	
Fire Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cutting, welding, or grinding generated sparks or heat sources		<input type="checkbox"/> Flammable materials present	<input type="checkbox"/> Oxygen enriched location		
Ergonomic Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Lifting	<input checked="" type="checkbox"/> Bending	<input checked="" type="checkbox"/> Twisting	<input checked="" type="checkbox"/> Pulling/tugging	<input type="checkbox"/> Repetitive motion	
Computer Use in the:		<input checked="" type="checkbox"/> Office	<input type="checkbox"/> Field	<input type="checkbox"/> _____		
Radiological Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Loose contamination	<input type="checkbox"/> Fixed Contamination	<input type="checkbox"/> Airborne contamination	<input type="checkbox"/> Radiation	<input type="checkbox"/> Radon	
<input type="checkbox"/> Alpha	<input type="checkbox"/> Beta	<input type="checkbox"/> Gamma/X-rays	<input type="checkbox"/> Neutron	<input type="checkbox"/> EMF	<input type="checkbox"/> Criticality	<input type="checkbox"/> Tritium
<input type="checkbox"/> Depleted Uranium		<input type="checkbox"/> Enriched Uranium	<input type="checkbox"/> _____	<input type="checkbox"/> _____		
Other Hazards						
<input type="checkbox"/>						

Completed by: Douglas Saigh Date: 07/20/11
 Form ESH-2.9.1-3.3
 37156
 4.08.01

CORPORATE ES&H PROCEDURE

ISSUED: 1/23/06 EFFECTIVE: 1/24/06 ESH-2.9.1 Revision 2
 OWNER: H.J. GORDON APPROVER: S. D. RIMA Page 2 of 6

PPE and Monitoring Requirements

Standard PPE					
<input checked="" type="checkbox"/> Hard Hat	<input checked="" type="checkbox"/> Safety shoes	<input checked="" type="checkbox"/> Safety glasses	<input checked="" type="checkbox"/> Boot Covers	<input type="checkbox"/> Rubber Boots	<input checked="" type="checkbox"/> High Visibility Vest
Eye and Face Protection					
<input type="checkbox"/> Welding glasses	<input type="checkbox"/> Welding helmet	<input type="checkbox"/> Face shield	<input type="checkbox"/> Chemical goggles	<input type="checkbox"/> Welding screens	
Hearing Protection					
<input checked="" type="checkbox"/> Ear plugs	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Ear plugs and muffs	<input type="checkbox"/> Other _____		
Respiratory Protection					
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Upgrade Only	<input type="checkbox"/> Full Face APR	<input checked="" type="checkbox"/> Half Face APR	Cart. Type: <u>Asbestos</u>	<input type="checkbox"/> PAPR
<input type="checkbox"/> Airline respirator	<input type="checkbox"/> SCBA	<input type="checkbox"/> Dust mask	<input type="checkbox"/> _____		
Protective Clothing					
<input type="checkbox"/> Tyvek® coveralls	<input type="checkbox"/> Poly-coated Tyvek® Coveralls	<input type="checkbox"/> Saranex® Coveralls	<input type="checkbox"/> Fully encapsulating suit		
<input type="checkbox"/> Cotton coveralls	<input type="checkbox"/> Modesty Clothing	<input type="checkbox"/> Fire resistant clothing	<input type="checkbox"/> Other _____		
Hand Protection					
<input type="checkbox"/> None	<input type="checkbox"/> Cotton gloves	<input type="checkbox"/> Leather gloves	<input type="checkbox"/> Cut-resistant gloves	<input type="checkbox"/> Glove liners	
Outer Gloves					
<input checked="" type="checkbox"/> Nitrile	<input type="checkbox"/> Viton®	<input type="checkbox"/> Butyl	<input type="checkbox"/> Neoprene	<input type="checkbox"/> Other _____	
Inner Gloves					
<input type="checkbox"/> Nitrile	<input type="checkbox"/> Vinyl	<input type="checkbox"/> Latex	<input type="checkbox"/> Other _____		
Monitoring Requirements					
<input type="checkbox"/> Oxygen	<input type="checkbox"/> Flammable gases/vapors	<input type="checkbox"/> Toxic Gas/vapors	<input type="checkbox"/> Hydrogen Sulfide	Carbon Monoxide	
<input type="checkbox"/> Asbestos	<input type="checkbox"/> Full time IH coverage	<input type="checkbox"/> Part time IH coverage	<input type="checkbox"/> Be, Hg, Cr, Pb		
<input type="checkbox"/> Metals Specify: _____					
<input type="checkbox"/> Organic Vapors Specify: _____					
<input checked="" type="checkbox"/> None	<input type="checkbox"/> TLD required	<input type="checkbox"/> CAM	<input type="checkbox"/> Radon		
<input type="checkbox"/> Full time RCT coverage	<input type="checkbox"/> Part time RCT coverage	<input type="checkbox"/> Radioactive particulates	air	<input type="checkbox"/> Other _____	
<input type="checkbox"/> Other _____		<input type="checkbox"/> Other _____			

PPE and monitoring requirements completed by: Douglas Saigh Date: 07/20/11

CORPORATE ES&H PROCEDURE

ISSUED: 1/23/06 EFFECTIVE: 1/24/06 ESH-2.9.1 Revision 2
 OWNER: H.J. GORDON APPROVER: S. D. RIMA Page 3 of 6

JOB HAZARD ANALYSIS FORM

JHA No.: JHA - NOVI - 003 - 11 - 01

Job Title: Decontamination

Date of Analysis: 07/20/11

Job Location: Honeywell Lake Linden-C&H Power Plant Site

Project Manager: Dan Dyer

Applicable ES&H Procedures: 2.9.A - Hazardous Waste Operations and Emergency Response Program
 2.9.C - Respiratory Protection Program
 2.9.D - Personal Protective Equipment Program
 2.9.E - Hazard Communication Program
 2.5.1 - Heavy Equipment
 2.9.16 - Thermal Stress
 2.9.21 - Power and Hand Tools

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Establish Decontamination Station	1A) Materials Handling	1A) Materials Handling <ul style="list-style-type: none"> ▪ Use proper lifting techniques ▪ Use mechanical aids, if available, to move heavy items.
2. Decontamination / Steam cleaning.	2A) Struck by steam/hot water/pressure washing	2A) Struck by steam/hot water <ul style="list-style-type: none"> ▪ Workers not directly engaged in steam cleaning operations must stay clear. ▪ Workers using steam cleaning equipment must be trained on operation and safety devices/procedures using the owners/operators manual. ▪ Use face shield and safety glasses or goggles, if steam cleaning. ▪ Stay out of the splash/steam radius. ▪ Pressure washer must have dead man switch. ▪ Do not direct steam at anyone. ▪ Do not hold objects with your feet or hands. ▪ Ensure that direction of spray minimizes spread of contaminants of concern. ▪ Use shielding as necessary.
	2B) Exposure to contaminants	2B) Exposure to contaminants <ul style="list-style-type: none"> ▪ Conduct air monitoring (see HASP). ▪ Wear proper PPE. ▪ See MSDSs for hazards associated with the decon solutions used (if other than water alone us used).
	2C) Slips/Trips/Falls	2C) Slips/Trips/Falls <ul style="list-style-type: none"> ▪ Be cautious as ground/plastic can become slippery ▪ Use boots or boot covers with good traction
3. Vehicle Decontamination	3A) Vehicle traffic in and out of the CRZ	3A) Large Vehicle Traffic <ul style="list-style-type: none"> ▪ Always wear a hard hat, steel toe boots, and a high visibility vest (unless Tyveks are used and are high visibility). ▪ Vehicle drivers are not to exit the vehicle in the CRZ. ▪ Identify an individual to communicate with vehicle drivers and maintain order ▪ Trucks will be lined with plastic and kept out of direct contact with any contaminated materials during loading. Wear PPE

CORPORATE ES&H PROCEDURE

ISSUED: 1/23/06 EFFECTIVE: 1/24/06 ESH-2.9.1 Revision 2
 OWNER: H.J. GORDON APPROVER: S. D. RIMA Page 4 of 6

Key Work Steps	Hazards/Potential Hazards	Safe Practices
		when removing plastic lining from truck beds. <ul style="list-style-type: none"> ▪ If not in the vehicle, obtain eye contact with the driver, so he is aware of your presence and location in the CRZ. ▪ If you are driving the vehicle, be aware of personnel in the CRZ and maintain communication with the identified personnel.
	3B) Exposure to contaminants	3B) Exposure to contaminants <ul style="list-style-type: none"> ▪ Use safety glasses or goggles, Polycoated Tyvek (if level of contamination poses dermal hazard or to keep work clothes dry), high visibility vest (if high visibility Tyveks are not used) hard hats, steel toe boots, and gloves while cleaning contaminated materials. ▪ Do not doff PPE until decontamination of the vehicle is complete and a decontamination certificate has been issued by the HSO. ▪ Conduct air monitoring (see HASP). ▪ See MSDSs for hazards associated with the decon solutions (if other than water alone is used).
	3C) Slips/Trips/Falls	3C) Slips/Trips/Falls <ul style="list-style-type: none"> ▪ Be cautious as ground/plastic can become slippery ▪ Use boots or boot covers with good traction
4. Equipment and Sample Decontamination	4A) Chemical exposure when handling contaminated sample jars and equipment	4A) Chemical exposure <ul style="list-style-type: none"> ▪ Wear PPE. ▪ Refer to MSDS for specific hazards associated with decon solutions ▪ Monitor breathing zone for contaminants ▪ Monitor breathing zone for decon solutions (e.g., methanol, hexane, etc.) if appropriate (see HASP)
	4B) Materials Handling related injuries	4B) Materials Handling related injuries <ul style="list-style-type: none"> ▪ Use proper lifting techniques when lifting heavy equipment ▪ Use two person lift for heavy coolers
5. Personal Decontamination	5A) Exposure to contaminants	5A) Exposure to contaminants <ul style="list-style-type: none"> ▪ Avoid bringing contaminated materials via shoes and clothing into the CRZ by examining such prior to exiting the EZ. ▪ Removal of PPE will be performed by the following tasks in the listed order: <ul style="list-style-type: none"> ▪ Gross boot wash and rinse and removal ▪ Outer glove removal ▪ Suit removal ▪ Respirator removal (if worn). ▪ Inner glove removal ▪ Contaminated PPE is to be placed in the appropriate, provided receptacles. ▪ Respirators will be removed and decontaminated at a specified location within the CRZ by a designated technician, then placed in storage bag. ▪ Employees will wash hands, face, and any other exposed areas with soap and water. ▪ Portable eyewash stations and showers will be available should employees come into direct contact with contaminated materials. ▪ See MSDSs for hazards associated with the decontamination solutions used. ▪ Decon solutions will be disposed of according to the work plan.

CORPORATE ES&H PROCEDURE

ISSUED: 1/23/06 EFFECTIVE: 1/24/06 ESH-2.9.1 Revision 2
 OWNER: H.J. GORDON APPROVER: S. D. RIMA Page 5 of 6

Identify Hazards and PPE

Complete the checklists for hazard identification and PPE requirements. Information from the RA and applicable permits are included in this section.

Standard Hazards						
<input type="checkbox"/> Falling Objects	<input checked="" type="checkbox"/> Slips and trips	<input type="checkbox"/> Pinch points	<input type="checkbox"/> Rotating equipment			
<input type="checkbox"/> Falls	<input type="checkbox"/> Power equipment/tools	<input type="checkbox"/> Elevated work surfaces	<input type="checkbox"/> _____			
Eye Hazards						
<input type="checkbox"/> Particulates	<input checked="" type="checkbox"/> Liquid splashes	<input type="checkbox"/> Welding Arc	<input type="checkbox"/> _____			
Hearing Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Impact noise	<input type="checkbox"/> High frequency noise	<input type="checkbox"/> High ambient noise			
Respiratory Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Dust/particulates	<input type="checkbox"/> Organic Vapors	<input type="checkbox"/> Acid Gases	<input type="checkbox"/> Radon	<input type="checkbox"/> Asbestos	<input type="checkbox"/> Be, Hg, Cr, Pb
<input type="checkbox"/> Oxygen deficient	<input type="checkbox"/> Welding fumes	<input type="checkbox"/> Aerosols/Particulates	<input type="checkbox"/> _____			
Chemical Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Organic solvents	<input checked="" type="checkbox"/> Reactive metals	<input type="checkbox"/> PCBs			
<input type="checkbox"/> Acids / bases	<input type="checkbox"/> Oxidizers	<input type="checkbox"/> Volatiles / Semi-volatiles	<input type="checkbox"/> _____			
Environmental Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Temperature extremes: <input checked="" type="checkbox"/> Cold <input checked="" type="checkbox"/> Heat	<input checked="" type="checkbox"/> Wet location	<input type="checkbox"/> Explosive vapors	<input type="checkbox"/> Confined space	<input type="checkbox"/> Engulfment Hazard	
<input type="checkbox"/> Bio hazards (poisonous plants, insects, animals, fungus, etc.)			<input type="checkbox"/> _____			
Electrical Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Overhead utilities	<input type="checkbox"/> Underground utilities	<input type="checkbox"/> Hidden utilities	<input type="checkbox"/> Energized equip/circuits	<input type="checkbox"/> Wet location	
Fire Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cutting, welding, or grinding generated sparks or heat sources	<input type="checkbox"/> Flammable materials present	<input type="checkbox"/> Oxygen enriched location			
Ergonomic Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Lifting	<input checked="" type="checkbox"/> Bending	<input type="checkbox"/> Twisting	<input checked="" type="checkbox"/> Pulling/tugging	<input type="checkbox"/> Repetitive motion	
Computer Use in the:		<input checked="" type="checkbox"/> Office	<input type="checkbox"/> Field	<input type="checkbox"/> _____		
Radiological Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Loose contamination	<input type="checkbox"/> Fixed Contamination	<input type="checkbox"/> Airborne contamination	<input type="checkbox"/> Radiation	<input type="checkbox"/> Radon	
<input type="checkbox"/> Alpha	<input type="checkbox"/> Beta	<input type="checkbox"/> Gamma/X-rays	<input type="checkbox"/> Neutron	<input type="checkbox"/> EMF	<input type="checkbox"/> Criticality	<input type="checkbox"/> Tritium
<input type="checkbox"/> Depleted Uranium	<input type="checkbox"/> Enriched Uranium	<input type="checkbox"/> _____		<input type="checkbox"/> _____		
Other Hazards						
<input type="checkbox"/>						

Completed by: Douglas Saigh Date: 07/20/11

CORPORATE ES&H PROCEDURE

ISSUED: 1/23/06 EFFECTIVE: 1/24/06 ESH-2.9.1 Revision 2
 OWNER: H.J. GORDON APPROVER: S. D. RIMA Page 6 of 6

PPE and Monitoring Requirements

Standard PPE					
<input checked="" type="checkbox"/> Hard Hat	<input checked="" type="checkbox"/> Safety shoes	<input checked="" type="checkbox"/> Safety glasses	<input checked="" type="checkbox"/> Boot Covers	<input type="checkbox"/> Rubber Boots	<input checked="" type="checkbox"/> High Visibility Vest
Eye and Face Protection					
<input type="checkbox"/> Welding glasses	<input type="checkbox"/> Welding helmet	<input type="checkbox"/> Face shield	<input type="checkbox"/> Chemical goggles	<input type="checkbox"/> Welding screens	
Hearing Protection					
<input type="checkbox"/> Ear plugs	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Ear plugs and muffs	<input type="checkbox"/> Other _____		
Respiratory Protection					
<input type="checkbox"/> None	<input type="checkbox"/> Upgrade Only	<input type="checkbox"/> Full Face APR	<input type="checkbox"/> Half Face APR	Cart. Type:	<input type="checkbox"/> PAPR
<input type="checkbox"/> Airline respirator	<input type="checkbox"/> SCBA	<input type="checkbox"/> Dust mask	<input type="checkbox"/> _____		
Protective Clothing					
<input type="checkbox"/> Tyvek® coveralls	<input type="checkbox"/> Poly-coated Tyvek® Coveralls	<input type="checkbox"/> Saranex® Coveralls	<input type="checkbox"/> Fully encapsulating suit		
<input type="checkbox"/> Cotton coveralls	<input type="checkbox"/> Modesty Clothing	<input type="checkbox"/> Fire resistant clothing	<input type="checkbox"/> Other _____		
Hand Protection					
<input type="checkbox"/> None	<input type="checkbox"/> Cotton gloves	<input type="checkbox"/> Leather gloves	<input type="checkbox"/> Cut-resistant gloves	<input type="checkbox"/> Glove liners	
Outer Gloves					
<input checked="" type="checkbox"/> Nitrile	<input type="checkbox"/> Viton®	<input type="checkbox"/> Butyl	<input type="checkbox"/> Neoprene	<input type="checkbox"/> Other _____	
Inner Gloves					
<input type="checkbox"/> Nitrile	<input checked="" type="checkbox"/> Vinyl	<input type="checkbox"/> Latex	<input type="checkbox"/> Other _____		
Monitoring Requirements					
<input type="checkbox"/> Oxygen	<input type="checkbox"/> Flammable gases/vapors	<input type="checkbox"/> Toxic Gas/vapors	<input type="checkbox"/> Hydrogen Sulfide	Carbon Monoxide	
<input type="checkbox"/> Asbestos	<input type="checkbox"/> Full time IH coverage	<input type="checkbox"/> Part time IH coverage	<input type="checkbox"/> Be, Hg, Cr, Pb		
<input type="checkbox"/> Metals Specify: _____					
<input type="checkbox"/> Organic Vapors Specify: _____					
<input checked="" type="checkbox"/> None	<input type="checkbox"/> TLD required	<input type="checkbox"/> CAM	<input type="checkbox"/> Radon		
<input type="checkbox"/> Full time RCT coverage	<input type="checkbox"/> Part time RCT coverage	<input type="checkbox"/> Radioactive air particulates	<input type="checkbox"/> Other _____		
<input type="checkbox"/> Other _____		<input type="checkbox"/> Other _____			

PPE and monitoring requirements completed by: Douglas Saigh Date: 07/20/11

CORPORATE ES&H PROCEDURE

Issued: **1/23/06** Effective: **1/24/06** **ESH-2.9.1 REVISION 2**
 Owner: **H.J. Gordon** Approver: **S. D. Rima** **PAGE 1 OF 6**

Job Hazard Analysis Form

JHA No.: JHA - Novi - 004 - 11 - 01

Job Title: Soil Sampling – Direct Push Soil Sampling

Date of Analysis: 07/20/11

Job Location: Honeywell Lake Linden-C&H Power Plant Site

Proj. Mgr.: Dan Dyer

Minimum Recommended PPE*: Hard hat, steel-toed boots, safety glasses and hearing protection (when Geoprobe is operating), and a high visibility vest.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Prepare for sampling event	1A) Chemical exposure 1B) Underground utilities	1A) Chemical Exposure <ul style="list-style-type: none"> ▪ Read HASP to determine air monitoring. ▪ Read HASP / JHA to determine PPE needs. 1B) Confirm that underground utilities have been clearly marked
2. Carrying equipment to site location (if inaccessible by field vehicle)	2A) Back or muscle strain	2A) Back or muscle strain <ul style="list-style-type: none"> ▪ Use proper lifting techniques when lifting heavy items ▪ Use mechanical aids if available ▪ Use 2 person lift for heavy items
3. Calibrate air monitoring equipment (i.e. PID or FID)	1A) Exposure to calibration gases	3A) Exposure to calibration gases <ul style="list-style-type: none"> ▪ Review equipment manuals ▪ Calibrate in a clean, well ventilated area
4. Preparing sampling location	4A) Watch out for other vehicles driving in the parking lot area.	4A) Watch out for other vehicles driving in the parking lot area. <ul style="list-style-type: none"> • Use flagging and/or traffic cones to delineate the hot zone (work zone) to prevent entry of unauthorized personnel • Wear high visibility vest. • Be aware of your surroundings at all times.
	4B) Mishaps due to loose equipment	4B) Mishaps due to loose equipment <ul style="list-style-type: none"> ▪ Maintain good housekeeping. ▪ Keep equipment out of the driving lanes. ▪ If necessary, wear protective netting over your head/face.
	4C) Unauthorized personnel in the hot zone (work zone)	4C) Use flagging and/or traffic cones to delineate the hot zone (work zone) to prevent entry of unauthorized personnel <ul style="list-style-type: none"> • Wear required PPE as described in the HASP / JHA once soil sampling activities begin.

CORPORATE ES&H PROCEDURE

Issued: **1/23/06** Effective: **1/24/06** **ESH-2.9.1 REVISION 2**

Owner: **H.J. Gordon** Approver: **S. D. Rima** **PAGE 2 OF 6**

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	4D) Exposure to hazardous Inhalation and contact with hazardous substances (VOC contaminated soil); flammable atmospheres.	4D) Exposure to hazardous substances <ul style="list-style-type: none"> ▪ Wear PPE as identified in HASP/ JHA once soil sampling activities commence. ▪ Review hazardous properties of site contaminants with workers before sampling operations begin ▪ Monitor breathing zone air in accordance with HASP to determine levels of contaminants present. ▪ When decontaminating equipment wear additional eye/face protection over the safety glasses such as a face shield.
	4E) Back strain due to lifting or moving equipment to sampling locations	4E) Back strain <ul style="list-style-type: none"> ▪ Use mechanical aids when possible, if mechanical aids are not available, use two person lifts for heavy items. ▪ Use proper lifting techniques
	4F) Foot injuries from dropped equipment	4F) Foot Injuries <ul style="list-style-type: none"> ▪ Be aware when moving objects, ensure you have a good grip when lifting and carrying objects. ▪ Do not carry more than you can handle safely ▪ Wear steel toed boots
5. Collecting soil samples	5A) Working around Geoprobe rigs	5A) Be aware of the Geoprobe's operation and movements during all phases of sampling activities. Communicate project requirements to the operator prior to commencing sampling activities.
	5B) Encountering underground or overhead utilities	5B) Have all utilities located.
	5C) Electrocutation	5C) Electrocutation <ul style="list-style-type: none"> ▪ A ground fault circuit interrupter (GFCI) device must protect all AC electrical circuits. ▪ Use only correctly grounded equipment. Never use three-pronged cords which have had the third prong broken off. ▪ Make sure that the electrical cords from generators and power tools are not allowed to be in contact with water ▪ Do not stand in wet areas while operating power equipment ▪ Always make sure all electrically-powered sampling equipment is in good repair. Report any problems so the equipment can be repaired or replaced. ▪ When unplugging a cord, pull on the plug rather than the cord. ▪ Never do repairs on electrical equipment unless you are both authorized and qualified to do so.
	5D) Exposure to contaminants / low level radiation	5D) Exposure to Contaminants / low level radiation <ul style="list-style-type: none"> ▪ Stand up wind when sampling and do not breathe dust (if conditions are dusty) ▪ Monitor breathing zone with appropriate monitoring equipment (see HASP) ▪ Continually monitor soil samples for low level radiation. ▪ Wear chemical resistant PPE as identified in HASP / JHA ▪ See section 4C) under Safe Practices above
	5E) Exposure to preservatives	5E) Exposure to preservatives <ul style="list-style-type: none"> ▪ Work in a well ventilated area, upwind of samples ▪ Wear chemical resistant PPE as identified in HASP / JHA. ▪ Review MSDSs

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2

Owner: H.J. Gordon Approver: S. D. Rima PAGE 3 OF 6

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	5F) Slips/trips/falls	5F) Slips/trips/falls <ul style="list-style-type: none"> ▪ Ground can become wet/muddy ▪ Wear good slip resistant footwear
	5G) Lifting Injury	5G) Lifting injury <ul style="list-style-type: none"> ▪ Use proper lifting techniques when carrying quantities of samples ▪ Use proper ergonomics when hand digging for samples
	5H) Eye injury	5H) Eye Injury <ul style="list-style-type: none"> ▪ Wear eye protection during operation of Geoprobe or if misc. debris may harm your eyes.
	5I) Fire	5I) Have an A-B-C rated fire extinguisher on hand in case of small equipment fires. Only individuals trained in fire extinguisher use should use a fire extinguisher.
6. Disposal of leftover soil.	6A) Contamination from impacted soil	6A) Properly dispose of any leftover soil sample <ul style="list-style-type: none"> ▪ Consult the Project Manager for proper disposal of soil. ▪ Don proper PPE when handling sample cores and disposing of soils. ▪ If soils are placed in a container (i.e. drum) properly label the drum.
7. Backfill Borehole.	7A) Contamination from impacted soil and/or groundwater	7A) Minimize contact with potentially impacted soil and/or groundwater <ul style="list-style-type: none"> ▪ Don proper PPE when backfilling the borehole. ▪ If the borehole is located in a paved area (i.e. asphalt/concrete), carefully patch the borehole using proper patching materials.

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 4 OF 6

Standard Hazards			
<input type="checkbox"/> Falling Objects	<input checked="" type="checkbox"/> Slips and trips	<input checked="" type="checkbox"/> Pinch points	<input type="checkbox"/> Rotating equipment
<input type="checkbox"/> Falls	<input checked="" type="checkbox"/> Direct Push drill rig	<input checked="" type="checkbox"/> Underground utilities	<input type="checkbox"/> _____
Eye Hazards			
<input type="checkbox"/> Particulates	<input type="checkbox"/> Liquid splashes	<input type="checkbox"/> Welding Arc	<input checked="" type="checkbox"/> Potential hazard during drill rig operation
Hearing Hazards			
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Impact noise during drill rig operation	<input type="checkbox"/> High frequency noise	<input type="checkbox"/> High ambient noise
Respiratory Hazards			
<input type="checkbox"/> None	<input type="checkbox"/> Dust/particulates	<input type="checkbox"/> Organic Vapors	<input type="checkbox"/> Acid Gases
<input type="checkbox"/> Oxygen deficient	<input type="checkbox"/> Welding fumes	<input type="checkbox"/> Aerosols/Particulates	<input type="checkbox"/> Be, Hg, Cr, Pb
<input type="checkbox"/> _____	<input type="checkbox"/> Radon	<input type="checkbox"/> Asbestos	<input type="checkbox"/> _____
Chemical Hazards			
<input type="checkbox"/> None	<input type="checkbox"/> Organic solvents	<input checked="" type="checkbox"/> Metals	<input checked="" type="checkbox"/> PCBs
<input type="checkbox"/> Acids / bases	<input type="checkbox"/> Oxidizers	<input type="checkbox"/> Volatiles / Semi-volatiles	<input type="checkbox"/> _____

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 5 OF 6

Environmental Hazards			
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Temperature extremes (Dress appropriately for the expected weather)	<input type="checkbox"/> Wet location	<input checked="" type="checkbox"/> Bio hazards (snakes, insects, spiders, bird / mouse droppings, fungus, etc.)
<input type="checkbox"/> Explosive vapors	<input type="checkbox"/> Confined space	<input type="checkbox"/> Engulfment Hazard	<input type="checkbox"/> _____
Electrical Hazards			
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Energized equipment or circuits	<input checked="" type="checkbox"/> Overhead utilities <input checked="" type="checkbox"/> Underground utilities <input type="checkbox"/> Hidden utilities	<input type="checkbox"/> Wet location
Fire Hazards			
<input checked="" type="checkbox"/> None expected	<input type="checkbox"/> Cutting, welding, or grinding generated sparks or heat sources	<input type="checkbox"/> Flammable materials present	<input type="checkbox"/> Oxygen enriched location
Ergonomic Hazards			
<input checked="" type="checkbox"/> Lifting	<input checked="" type="checkbox"/> Bending	<input checked="" type="checkbox"/> Twisting	<input checked="" type="checkbox"/> Pulling/tugging
Computer Use in the: <input checked="" type="checkbox"/> Office <input type="checkbox"/> Field	<input type="checkbox"/> Repetitive motion	<input type="checkbox"/> _____	<input type="checkbox"/> _____
Radiological Hazards			
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Loose contamination	<input type="checkbox"/> Fixed Contamination	<input type="checkbox"/> Low Level Radiation
<input type="checkbox"/> Airborne contamination	<input type="checkbox"/> Radon	<input type="checkbox"/> EMF	<input type="checkbox"/> Criticality
<input type="checkbox"/> Alpha	<input type="checkbox"/> Beta	<input type="checkbox"/> Gamma/X-rays	<input type="checkbox"/> Neutron
<input type="checkbox"/> Tritium	<input type="checkbox"/> TRU	<input type="checkbox"/> Depleted Uranium	<input type="checkbox"/> Enriched Uranium
Other Hazards			
<input checked="" type="checkbox"/> Hazards associated with working on unlevel ground surfaces.			
<input type="checkbox"/>			
<input type="checkbox"/>			
<input type="checkbox"/>			

Completed by: Douglas Saigh Date: 07/20/11

CORPORATE ES&H PROCEDURE

Issued: **1/23/06** Effective: **1/24/06** **ESH-2.9.1 REVISION 2**
 Owner: **H.J. Gordon** Approver: **S. D. Rima** **PAGE 6 OF 6**

PPE and Monitoring Requirements

Standard PPE (Level D)			
<input checked="" type="checkbox"/> Hard Hat	<input checked="" type="checkbox"/> Safety shoes	<input checked="" type="checkbox"/> Safety glasses (during operation of Geoprobe rig)	<input checked="" type="checkbox"/> Boot Covers
<input type="checkbox"/> Aprons	<input type="checkbox"/> Rubber Boots	<input checked="" type="checkbox"/> High visibility vest	<input type="checkbox"/> Other: _____
Eye Protection			
<input type="checkbox"/> Welding glasses <input type="checkbox"/> Welding helmet	<input type="checkbox"/> Face Shield	<input type="checkbox"/> Chemical goggles	<input type="checkbox"/> Welding screens
Hearing Protection			
<input checked="" type="checkbox"/> Ear plugs (during operation of Geoprobe rig)	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Ear plugs and muffs	<input type="checkbox"/> Other _____
Respiratory Protection			
<input checked="" type="checkbox"/> Follow air monitoring guidelines in HASP	<input type="checkbox"/> Dust mask	<input type="checkbox"/> Full Face APR <input type="checkbox"/> Half Face APR Cart. Type	<input type="checkbox"/> PAPR Cart. Type
<input type="checkbox"/> SCBA	<input type="checkbox"/> Airline respirator	<input type="checkbox"/>	<input type="checkbox"/>
Protective Clothing			
<input type="checkbox"/> Tyvek® coveralls	<input type="checkbox"/> Poly-coated Tyvek® Coveralls (if splashing of water occurs)	<input type="checkbox"/> Saranex® Coveralls	<input type="checkbox"/> Fully encapsulating suit
<input type="checkbox"/> Cotton coveralls	<input type="checkbox"/> Modesty Clothing	<input type="checkbox"/> Fire resistant clothing	<input checked="" type="checkbox"/> Other: Long pants; long sleeve shirt
Hand Protection			
<input type="checkbox"/> None	<input type="checkbox"/> Cotton gloves	<input type="checkbox"/> Leather gloves	<input type="checkbox"/> Glove liners
<input checked="" type="checkbox"/> Nitrile gloves <input type="checkbox"/> Viton® gloves <input type="checkbox"/> Butyl gloves <input type="checkbox"/> Neoprene gloves	Surgical gloves <input type="checkbox"/> Latex <input type="checkbox"/> Non-Latex	<input type="checkbox"/> Cut-resistant gloves	<input type="checkbox"/> Other:
Monitoring Requirements			
<input type="checkbox"/> Oxygen	<input type="checkbox"/> Flammable gases/vapors	<input type="checkbox"/> Toxic Gas/vapors	<input type="checkbox"/> Hydrogen Sulfide/Carbon Monoxide
<input type="checkbox"/> Asbestos	<input type="checkbox"/> Full time IH coverage	<input type="checkbox"/> Part time IH coverage	<input type="checkbox"/> Be, Hg, Cr, Pb
<input type="checkbox"/> Metals Specify:			
<input type="checkbox"/> Organic vapors :			
<input type="checkbox"/> Radioactive air particulates	<input type="checkbox"/> TLD required	<input type="checkbox"/> CAM	<input type="checkbox"/> Radon
<input type="checkbox"/> Full time RCT coverage	<input type="checkbox"/> Part time RCT coverage	<input type="checkbox"/> Radioactive air particulates	<input type="checkbox"/> Other _____
<input type="checkbox"/> Low Level Radiation :		<input type="checkbox"/> Other _____	

PPE and monitoring requirements completed by: Douglas Saigh Date: 07/20/11

CORPORATE ES&H PROCEDURE

Issued: **1/23/06** Effective: **1/24/06** **ESH-2.9.1 REVISION 2**
 Owner: **H.J. Gordon** Approver: **S. D. Rima** **PAGE 1 OF 5**

Job Hazard Analysis Form

JHA No.: JHA - NOVI - 005 - 11 - 01

Job Title: Excavation and Backfilling

Date of Analysis: 07/20/11

Job Location: Honeywell Lake Linden-C&H Power Plant Site

Project Manager: Dan Dyer

- Applicable ES&H Procedures:**
- 2.9.A - Hazardous Waste Operations and Emergency Response Program
 - 2.9.B - Hearing Conservation Program
 - 2.9.C - Respiratory Protection Program
 - 2.9.D - Personal Protective Equipment Program
 - 2.5.2 - Heavy Equipment
 - 2.9.7 - Overhead and Underground Utilities
 - 2.9.9 - Excavation and Trenching
 - 2.14.5 - Collection of Field Samples
- Other Referenced JHAs:
- Confined Space Entry JHA

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Identify location of underground utilities	1A) Encountering electrical, gas, communications, water, or other underground utility lines	1A) Identify utility locations prior to mobilizing: <ul style="list-style-type: none"> ▪ Contact "Dig Safe" and obtain a permit (or one call center) to have underground utilities located and marked prior to any subsurface work on site. ▪ Use facility engineers and/or employ a private utility locator for utilities on private property
2. Excavation of soils	2A) Underground utilities	2A) Underground utilities <ul style="list-style-type: none"> ▪ Work at adequate offsets from utility locations ▪ For areas where utility locations cannot be verified, workers must hand dig for the first 3 feet ▪ Immediately cease work if unknown utility markings are discovered. ▪ Conform to utility clearances based on voltage of lines. For powerlines of 50 KV or less stay at least 10 feet away. For powerlines of > 50 KV, add an additional 0.4 inches per KV over 50 KV. Rule of thumb: Stay 10 feet away if powerline <u>known</u> to be 50 KV or less. Stay 35 feet away for lines > 50 KV or if voltage is unknown.

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2

Owner: H.J. Gordon Approver: S. D. Rima PAGE 2 OF 5

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	2B) Vapor/Dust Exposure	2B) Vapor/Dust Exposure <ul style="list-style-type: none"> ▪ Conduct breathing zone air monitoring as described in the HASP. ▪ Implement dust control measures as applicable. ▪ Wear proper PPE (see HASP).
	2C) Odors	2C) Odors <ul style="list-style-type: none"> ▪ Implement odor control mitigation in accordance with the Site Management Plan.
	2D) Heavy Equipment	2D) Heavy Equipment <ul style="list-style-type: none"> ▪ See General Site Hazards
	2E) Cave-ins	2E) Cave-ins Excavation work must be conducted in accordance with OSHA 1926 Subpart P (650-652) Excavations including but not limited to: <ul style="list-style-type: none"> ▪ Designate a competent person to inspect, decide soil classification, proper sloping, the correct shoring, or sheeting for the excavation ▪ Walls and faces of trenches 5 feet or more deep, and all excavations in which employees may be exposed to danger from moving ground or cave-in shall be guarded by a shoring system, sloping of the ground, or some other equivalent means. ▪ Cordon-off the perimeter of the excavation to delineate cave-in hazard area. ▪ Construct diversion ditches or dikes to prevent surface water from entering excavation and provide good drainage of the areas surrounding the excavation. ▪ Collect ground water/rain water from excavation and dispose of properly ▪ Store spoils, materials and equipment at least 2 feet from the edge of the excavation; prevent excessive loading of the excavation face. ▪ Inspect excavations (when personnel entry is required) daily, any time conditions change and document the inspection.
	2F) Slips/Trips/Falls	2F) Slips/Trips/Falls <ul style="list-style-type: none"> ▪ Provide sufficient egress (stairs, ladders, or ramps) when workers enter excavations over 4 feet in depth, and place these structures so that workers travel no more than 25 feet to reach ladders. Provide at least two means of exit for personnel working in excavations. ▪ Maintain minimum safe distance from the excavation and only approach the excavation on the short side.
	2G) Site Security	2G) Site Security <ul style="list-style-type: none"> ▪ Fill in excavation prior to leaving the site or provide barricades or fencing (able to withstand 200 lbs. of vertical pressure) to protect the excavation from the public and place warning signs on fence/barricade. ▪ Consider hiring a security guard ▪ If cover excavation with plywood or other material, ensure cover is labeled with the words "cover" or "hole."
3). Backfilling of Soils	3A) Heavy Equipment	3A) Heavy Equipment <ul style="list-style-type: none"> ▪ See General Site Hazards (Heavy Equipment)
	3B) Cave-ins	3B) Cave-ins <ul style="list-style-type: none"> ▪ See 2E above.

CORPORATE ES&H PROCEDURE

Issued: **1/23/06** Effective: **1/24/06** **ESH-2.9.1 REVISION 2**

Owner: **H.J. Gordon** Approver: **S. D. Rima** **PAGE 3 OF 5**

Key Work Steps	Hazards/Potential Hazards	Safe Practices
3. Identify location of underground utilities	1B) Encountering electrical, gas, communications, water, or other underground utility lines	1B) Identify utility locations prior to mobilizing: <ul style="list-style-type: none"> ▪ Contact "Dig Safe" and obtain a permit (or one call center) to have underground utilities located and marked prior to any subsurface work on site. ▪ Use facility engineers and/or employ a private utility locator for utilities on private property
4. Excavation of soils	2H) Underground utilities	2H) Underground utilities <ul style="list-style-type: none"> ▪ Work at adequate offsets from utility locations ▪ For areas where utility locations cannot be verified, workers must hand dig for the first 3 feet ▪ Immediately cease work if unknown utility markings are discovered. ▪ Conform to utility clearances based on voltage of lines. For powerlines of 50 KV or less stay at least 10 feet away. For powerlines of > 50 KV, add an additional 0.4 inches per KV over 50 KV. Rule of thumb: Stay 10 feet away if powerline <u>known</u> to be 50 KV or less. Stay 35 feet away for lines > 50 KV or if voltage is unknown.
	2I) Vapor/Dust Exposure	2I) Vapor/Dust Exposure <ul style="list-style-type: none"> ▪ Conduct breathing zone air monitoring as described in the HASP. ▪ Implement dust control measures as applicable. ▪ Wear proper PPE (see HASP).

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 4 OF 5

Identify Hazards and PPE

Complete the checklists for hazard identification and PPE requirements. Information from the RA and applicable permits are included in this section.

Standard Hazards						
<input type="checkbox"/> Falling Objects	<input checked="" type="checkbox"/> Slips and trips	<input type="checkbox"/> Pinch points	<input type="checkbox"/> Rotating equipment			
<input checked="" type="checkbox"/> Falls	<input type="checkbox"/> Power equipment/tools	<input checked="" type="checkbox"/> Elevated work surfaces	<input type="checkbox"/> _____			
Eye Hazards						
<input checked="" type="checkbox"/> Particulates	<input type="checkbox"/> Liquid splashes	<input type="checkbox"/> Welding Arc	<input type="checkbox"/> _____			
Hearing Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Impact noise	<input type="checkbox"/> High frequency noise	<input checked="" type="checkbox"/> High ambient noise			
Respiratory Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Dust/particulates	<input type="checkbox"/> Organic Vapors	<input type="checkbox"/> Acid Gases	<input type="checkbox"/> Radon	<input type="checkbox"/> Asbestos	<input type="checkbox"/> Be, Hg, Cr, Pb
<input type="checkbox"/> Oxygen deficient	<input type="checkbox"/> Welding fumes	<input type="checkbox"/> Aerosols/Particulates	<input type="checkbox"/> _____			
Chemical Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Organic solvents	<input checked="" type="checkbox"/> Reactive metals	<input checked="" type="checkbox"/> PCBs			
<input type="checkbox"/> Acids / bases	<input type="checkbox"/> Oxidizers	<input type="checkbox"/> Volatiles / Semi-volatiles	<input type="checkbox"/> _____			
Environmental Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Temperature extremes: <input checked="" type="checkbox"/> Cold <input checked="" type="checkbox"/> Heat	<input type="checkbox"/> Wet location	<input type="checkbox"/> Explosive vapors	<input type="checkbox"/> Confined space	<input checked="" type="checkbox"/> Engulfment Hazard	
<input checked="" type="checkbox"/> Bio hazards (poisonous plants, insects, animals, animal droppings, mold, fungus, etc.)			<input type="checkbox"/> _____			
Electrical Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Overhead utilities	<input checked="" type="checkbox"/> Underground utilities	<input type="checkbox"/> Hidden utilities	<input type="checkbox"/> Energized equip/circuits	<input type="checkbox"/> Wet location	
Fire Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cutting, welding, or grinding generated sparks or heat sources	<input type="checkbox"/> Flammable materials present	<input type="checkbox"/> Oxygen enriched location			
Ergonomic Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Lifting	<input checked="" type="checkbox"/> Bending	<input type="checkbox"/> Twisting	<input type="checkbox"/> Pulling/tugging	<input type="checkbox"/> Repetitive motion	
Computer Use in the:	<input checked="" type="checkbox"/> Office	<input type="checkbox"/> Field	<input type="checkbox"/> _____			
Radiological Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Loose contamination	<input type="checkbox"/> Fixed Contamination	<input type="checkbox"/> Airborne contamination	<input type="checkbox"/> Radiation	<input type="checkbox"/> Radon	
<input type="checkbox"/> Alpha	<input type="checkbox"/> Beta	<input type="checkbox"/> Gamma/X-rays	<input type="checkbox"/> Neutron	<input type="checkbox"/> EMF	<input type="checkbox"/> Criticality	<input type="checkbox"/> Tritium <input type="checkbox"/> TRU
<input type="checkbox"/> Depleted Uranium	<input type="checkbox"/> Enriched Uranium	<input type="checkbox"/> _____		<input type="checkbox"/> _____		
Other Hazards						
<input type="checkbox"/>						

Completed by: Douglas Saigh Date: 07/20/11

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 5 OF 5

PPE and Monitoring Requirements

Standard PPE					
<input checked="" type="checkbox"/> Hard Hat	<input checked="" type="checkbox"/> Safety shoes	<input checked="" type="checkbox"/> Safety glasses	<input checked="" type="checkbox"/> Boot Covers	<input type="checkbox"/> Rubber Boots	<input checked="" type="checkbox"/> High Visibility Vest
Eye and Face Protection					
<input type="checkbox"/> Welding glasses	<input type="checkbox"/> Welding helmet	<input type="checkbox"/> Face shield	<input type="checkbox"/> Chemical goggles	<input type="checkbox"/> Welding screens	
Hearing Protection					
<input checked="" type="checkbox"/> Ear plugs	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Ear plugs and muffs	<input type="checkbox"/> Other _____		
Respiratory Protection					
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Upgrade Only	<input type="checkbox"/> Full Face APR	<input checked="" type="checkbox"/> Half Face APR	Cart. Type <u>asbestos</u>	<input type="checkbox"/> PAPR
<input type="checkbox"/> Airline respirator	<input type="checkbox"/> SCBA	<input type="checkbox"/> Dust mask	<input type="checkbox"/> _____		
Protective Clothing					
<input type="checkbox"/> Tyvek® coveralls	<input type="checkbox"/> Poly-coated Tyvek® Coveralls	<input type="checkbox"/> Saranex® Coveralls	<input type="checkbox"/> Fully encapsulating suit	<input type="checkbox"/> Apron	
<input type="checkbox"/> Cotton coveralls	<input type="checkbox"/> Modesty Clothing	<input type="checkbox"/> Fire resistant clothing	<input type="checkbox"/> Other _____		
Hand Protection					
<input type="checkbox"/> None	<input type="checkbox"/> Cotton gloves	<input type="checkbox"/> Leather gloves	<input type="checkbox"/> Cut-resistant gloves	<input type="checkbox"/> Glove liners	
Outer Gloves					
<input checked="" type="checkbox"/> Nitrile	<input type="checkbox"/> Viton®	<input type="checkbox"/> Butyl	<input type="checkbox"/> Neoprene	<input type="checkbox"/> Other _____	
Inner Gloves					
<input type="checkbox"/> Nitrile	<input type="checkbox"/> Vinyl	<input type="checkbox"/> Latex	<input type="checkbox"/> Other _____		
Other Required PPE					
<input type="checkbox"/> Personal Flotation Device	<input type="checkbox"/> Waders	<input type="checkbox"/> _____	<input type="checkbox"/> _____		
Monitoring Requirements					
<input type="checkbox"/> Oxygen	<input type="checkbox"/> Flammable gases/vapors	<input type="checkbox"/> Toxic Gas/vapors	<input type="checkbox"/> Hydrogen Sulfide	Carbon Monoxide	
<input type="checkbox"/> Asbestos	<input type="checkbox"/> Full time IH coverage	<input type="checkbox"/> Part time IH coverage	<input type="checkbox"/> Be, Hg, Cr, Pb		
<input type="checkbox"/> Metals Specify: _____					
<input type="checkbox"/> Organic Vapors Specify: _____					
<input type="checkbox"/> None	<input type="checkbox"/> TLD required	<input type="checkbox"/> CAM	<input type="checkbox"/> Radon		
<input type="checkbox"/> Full time RCT coverage	<input type="checkbox"/> Part time RCT coverage	<input type="checkbox"/> Radioactive air particulates	<input type="checkbox"/> Other _____		
<input type="checkbox"/> Other _____		<input type="checkbox"/> Other _____			

PPE and monitoring requirements completed by: Douglas Saigh Date: 07/20/11

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 1 OF 8

Job Hazard Analysis Form

JHA No.: JHA - NOVI - 006 - 11 - 01

Job Title: Construction Inspection

Date of Analysis: 07/20/11

Job Location: Honeywell Lake Linden-C&H Power Plant Site

Project Manager: Dan Dyer

REFERENCES

MACTEC ES&H Manual

- Personal Protective Equipment (PPE) Program (ESH-2.9.D)
- Operation of Company Vehicles and Use of Personal Vehicles on Company Business Procedure (ESH-2.5.1)
- Fall Protection Procedure (ESH-2.9.2)

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1) Drive vehicle to observation location	1a) Traffic accidents	1a-i) Always wear seat belts. Drive defensively/follow traffic regs. Check tires for proper inflation. Fill out vehicle maintenance check list prior to using vehicle. 1a-ii) Drive vehicle in accordance with company policy, drive in right lane, use 3 second rule or extended distance from vehicle in front of you, drive speed limit or slower depending upon conditions.
2) Perform fieldwork for construction inspections.	2a) Vehicle and heavy equipment operations	2a-i) Be aware of vehicle operations in your area. Make eye contact with vehicle operators on approaching equipment.
	2b) Trip and fall	2b-i) Be aware of your surroundings, and wear proper foot wear.
	2c) Heat exhaustion.	2c-i) Avoid dehydration. Avoid excessive sun or heat exposure. Wear hat, sunglasses, and sunscreen.
	2d) Insect bites and stings.	2d-i) Be aware of surroundings. Wear insect repellent.

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2

Owner: H.J. Gordon Approver: S. D. Rima PAGE 2 OF 8

	<p>2e) Falling from ladders/injury from dropped objects</p>	<p>2e-i) Use three point support system at all times when working on a ladder. Ensure ladder supports are firmly grounded before ascending a ladder. If ascending over 6 feet, use a personal fall protection system.</p> <p>2e-ii) Do not walk underneath ladders. Stay clear of areas where work is performed on ladders due to potential falling objects.</p>
	<p>2f) Hearing Hazards – excessive noise > 80 dba</p>	<p>2f-i) Use hearing protection</p>
	<p>2g) Stairs and Ramps</p>	<p>2g-i) Wear proper footwear. Exercise caution when ascending and descending stairs and ramps.</p>
	<p>2h) Inhalation hazards</p>	<p>2h-i) Conduct breathing zone air monitoring if there is potential exposure to vapor/dust above the PEL (reference OSHA 1910.1000Z section).</p> <p>2h-ii) Implement dust control measures as applicable.</p> <p>2h-iii) Wear proper PPE (safety glasses, hardhat, respirator if required by air monitoring results, hearing protection if 85 decibels or more).</p>
	<p>2i) Compressed gas cylinder hazards</p>	<p>2i-i) Store cylinders upright secured against stationary object.</p> <p>2i-ii) Use wheeled cart or motorized truck to move cylinder(s) weighing >40 lbs.</p> <p>2i-iii) Separate oxygen cylinders from flammable gases.</p> <p>2i-iv) Use tags to mark cylinders full, in use or empty.</p>
	<p>2j) Oxygen deficient atmosphere</p>	<p>2j-i) Perform pre-entry atmospheric testing by competent person. If hazardous, mark the spaces and prevent unauthorized entry.</p> <p>2j-ii) If entry is required, evaluate the hazards, specify acceptable entry conditions, develop system permitting entries, personnel training, air monitoring, and make provisions for rescue and emergency services (Reference OSHA 1910.146).</p>

CORPORATE ESH&H PROCEDURE

Issued: **1/23/06** Effective: **1/24/06** **ESH-2.9.1 REVISION 2**

Owner: **H.J. Gordon** Approver: **S. D. Rima** **PAGE 3 OF 8**

	<p>2k) Bodily injuries from unexpected startup or release of stored energy (electrical, chemical, mechanical, hydraulic, pneumatic, and thermal) gases or liquids.</p>	<p>2k-i) Be aware of site conditions, ongoing operations and potential hazards.</p> <p>2k-ii) Be aware of site evacuation plans and procedures.</p>
	<p>2l) Excavation hazards</p>	<p>2l-i) For excavations over 4 feet in depth, a competent person must inspect the trench daily or as hazardous conditions change.</p> <p>2l-ii) Trenches over 4 feet in depth must be adequately sloped, benched or shored with protective systems.</p> <p>2l-iii) Store all materials and soil at least 2 feet away from the side of the trench.</p> <p>2l-iv) Adequately support utilities crossing a trench.</p> <p>2l-v) Wear appropriate PPE and fall protection/rescue equipment.</p>
	<p>2m) Falls due to unsafe supports or scaffolding</p>	<p>2m-i) Construct all scaffolds in accordance with manufacturer's directions.</p> <p>2m-ii) For scaffolds 10 feet above a lower level, use guardrails and wear personal fall protection systems.</p> <p>2m-iii) Ensure guardrails on all open sides and end of platforms.</p> <p>2m-iv) Use safe access to scaffold platforms, do not use cross bracing for access.</p>
	<p>2n) Lifting heavy objects</p>	<p>2n-i) Use proper lifting and motion technique. Do not twist back, stay balanced and use your legs.</p>
	<p>2o) Incorrect PPE</p>	<p>2o-i) Always wear level D PPE (safety boots, hardhat, vest, safety glasses).</p> <p>2o-ii) Evaluate hazards of all operations and wear additional PPE if appropriate.</p>
	<p>2p) Fire and explosion hazards</p>	<p>2p-i) Ensure good housekeeping to prevent accumulations of wood dust.</p> <p>2p-ii) Ensure proper labeling, storage and handling of hazardous materials.</p> <p>2p-iii) Ensure controls on ignition sources.</p>

CORPORATE ESH&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2

Owner: H.J. Gordon Approver: S. D. Rima PAGE 4 OF 8

	2q) Confined space entry	<p>2q-i) Perform pre-entry atmospheric testing by competent person. If hazardous, mark the spaces and prevent unauthorized entry.</p> <p>2q-ii) If entry is required, evaluate the hazards, specify acceptable entry conditions, develop system permitting entries, personnel training, air monitoring, and make provisions for rescue and emergency services (Reference OSHA 1910.146).</p>
	2r) Gas welding and cutting operations	<p>2r-i) Review hot work permits if available.</p> <p>2r-ii) Ensure good housekeeping is maintained and adequate fire protection/fire watch equipment is available.</p> <p>2r-iii) Use appropriate PPE. Provide adequate ventilation for fumes and gases.</p> <p>2r-iv) Ensure compressed gas cylinders are far enough from hot work to prevent sparks or slag from contacting them. The cylinders should be stored in a carrier designed for that purpose.</p> <p>2r-v) Ensure precautions are taken in adjacent spaces.</p>
	2s) Electrical welding operations	<p>2s-i) Review hot work permits if available.</p> <p>2s-ii) Ensure good housekeeping is maintained and adequate fire protection/fire watch equipment is available.</p> <p>2s-iii) Use appropriate PPE. Provide adequate ventilation for fumes and gases.</p> <p>2s-iv) Ensure shielding for arc welding if appropriate.</p> <p>2s-v) Ensure precautions are taken in adjacent spaces.</p>
	2t) Working near energized electrical circuits	<p>2t-i) Stay at least 10 feet away from overhead power lines, assume they are energized unless you know otherwise.</p> <p>2t-ii) Ensure power lines are de-energized and grounded, or guarded if working near them.</p> <p>2t-iii) Use non-conducting wood or fiberglass ladders while working near power lines.</p>

CORPORATE ES&H PROCEDURE

Issued: **1/23/06** Effective: **1/24/06** **ESH-2.9.1 REVISION 2**

Owner: **H.J. Gordon** Approver: **S. D. Rima** **PAGE 5 OF 8**

	<p>2u) Rigging equipment hazards</p>	<p>2u-i) Rigging equipment must be inspected before each shift, and damaged, worn equipment must be replaced.</p> <p>2u-ii) Trained/qualified personnel must perform rigging operations. Do not exceed the lifting capacity of slings, chain falls, or weigh lifting equipment.</p> <p>2u-iii) Do not ride the load or hook.</p> <p>2u-iv) Workers should not be between a swing load and a fixed object.</p> <p>2u-v) Do not place fingers between sling and load when the sling is being tightened around the load.</p> <p>2u-vi) Stay clear of suspended loads or loads about to be lifted.</p>
	<p>2v) Material handling equipment operations</p>	<p>2v-i) Be aware of material handling equipment operations in your area. Make eye contact with vehicle operators on approaching equipment.</p>
	<p>2w) Portable electric tool hazards</p>	<p>2w-i) Ensure GFCIs are used on all power tools.</p> <p>2w-ii) Ensure proper use of extension cords and cords contain ground prongs.</p> <p>2w-iii) Ensure tool guards are installed and used.</p> <p>2w-iv) Use proper PPE and face shields if appropriate.</p> <p>2w-v) Perform daily inspection of tools, and remove broken or damaged tools from service.</p>
	<p>2x) Pneumatic tool hazards</p>	<p>2x-i) Use face shields and proper PPE.</p> <p>2x-ii) Ensure manufacturer's recommendations for air pressure and prescribed use are followed when using pneumatic tools.</p>

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2

Owner: H.J. Gordon Approver: S. D. Rima PAGE 6 OF 8

	<p>2y) Cranes, derricks and hoisting equipment operations</p>	<p>2y-i) Cranes, derricks and hoisting equipment must be operated by trained and qualified personnel.</p> <p>2y-ii) Ensure a 10 foot clearance between weight handling equipment and power lines.</p> <p>2y-iii) Remain clear of loads that are to be lifted or are suspended.</p> <p>2y-iv) Do not place yourself between swinging loads and fixed objects.</p> <p>2y-v) Be aware of your surroundings.</p>
	<p>2z) Flammable and combustible liquid hazards</p>	<p>2z-i) Ensure flammable and combustible liquids are stored in containers designed for that use.</p> <p>2z-ii) Ensure containers are labeled and properly stored. Do not store incompatible materials in the same location.</p> <p>2z-iii) Ensure a fire extinguisher or proper fire protection equipment is available.</p> <p>2z-iv) Immediately clean up flammable liquid spills.</p>
	<p>2aa) Site demolition operations</p>	<p>2aa-i) Be aware of heavy equipment operations and swing radius of equipment.</p> <p>2aa-ii) Ground personnel in vicinity of heavy equipment must be within view of the operator at all times.</p> <p>2aa-iii) Wear appropriate PPE (hardhat, safety glasses, vest and safety boots)</p> <p>2aa-iv) Be aware of construction operations around you.</p>
	<p>2bb) Improper sanitation</p>	<p>2bb-i) Ensure that properly maintained wash stations and toilet facilities are provided at the construction site.</p>
	<p>2cc) Unguarded protruding reinforcing steel</p>	<p>2cc-i) Ensure protruding reinforcing steel is either bent over or capped.</p>
	<p>2dd) Unprotected sides, wall openings and floor holes</p>	<p>2dd-i) Ensure unprotected sides, wall opening and floor holes have guardrails and are marked appropriately.</p>

Form ESH-2.9.1-3.1

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 7 OF 8

Identify Hazards and PPE

Complete the checklists for hazard identification and PPE requirements. Information from the RA and applicable permits are included in this section.

Standard Hazards						
<input type="checkbox"/> Falling Objects	<input checked="" type="checkbox"/> Slips and trips	<input checked="" type="checkbox"/> Pinch points	<input type="checkbox"/> Rotating equipment			
<input checked="" type="checkbox"/> Falls	<input type="checkbox"/> Power equipment/tools	<input checked="" type="checkbox"/> Elevated work surfaces	<input type="checkbox"/> _____			
Eye Hazards						
<input checked="" type="checkbox"/> Particulates	<input type="checkbox"/> Liquid splashes	<input type="checkbox"/> Welding Arc	<input type="checkbox"/> _____			
Hearing Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Impact noise	<input type="checkbox"/> High frequency noise	<input checked="" type="checkbox"/> High ambient noise			
Respiratory Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Dust/particulates	<input type="checkbox"/> Organic Vapors	<input type="checkbox"/> Acid Gases	<input type="checkbox"/> Radon	<input type="checkbox"/> Asbestos	<input type="checkbox"/> Be, Hg, Cr, Pb
<input type="checkbox"/> Oxygen deficient	<input type="checkbox"/> Welding fumes	<input type="checkbox"/> Aerosols/Particulates	<input type="checkbox"/> _____			
Chemical Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Organic solvents	<input checked="" type="checkbox"/> Reactive metals	<input checked="" type="checkbox"/> PCBs			
<input type="checkbox"/> Acids / bases	<input type="checkbox"/> Oxidizers	<input type="checkbox"/> Volatiles / Semi-volatiles	<input checked="" type="checkbox"/> Asbestos			
Environmental Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Temperature extremes: <input checked="" type="checkbox"/> Cold <input checked="" type="checkbox"/> Heat	<input type="checkbox"/> Wet location	<input type="checkbox"/> Explosive vapors	<input type="checkbox"/> Confined space	<input checked="" type="checkbox"/> Engulfment Hazard	
<input checked="" type="checkbox"/> Bio hazards (poisonous plants, insects, animals, animal droppings, mold, fungus, etc.)					<input type="checkbox"/> _____	
Electrical Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Overhead utilities	<input checked="" type="checkbox"/> Underground utilities	<input type="checkbox"/> Hidden utilities	<input type="checkbox"/> Energized equip/circuits	<input type="checkbox"/> Wet location	
Fire Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cutting, welding, or grinding generated sparks or heat sources	<input type="checkbox"/> Flammable materials present		<input type="checkbox"/> Oxygen enriched location		
Ergonomic Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Lifting	<input checked="" type="checkbox"/> Bending	<input type="checkbox"/> Twisting	<input type="checkbox"/> Pulling/tugging	<input type="checkbox"/> Repetitive motion	
Computer Use in the:	<input checked="" type="checkbox"/> Office	<input type="checkbox"/> Field	<input type="checkbox"/> _____			
Radiological Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Loose contamination	<input type="checkbox"/> Fixed Contamination	<input type="checkbox"/> Airborne contamination	<input type="checkbox"/> Radiation	<input type="checkbox"/> Radon	
<input type="checkbox"/> Alpha	<input type="checkbox"/> Beta	<input type="checkbox"/> Gamma/X-rays	<input type="checkbox"/> Neutron	<input type="checkbox"/> EMF	<input type="checkbox"/> Criticality	<input type="checkbox"/> Tritium <input type="checkbox"/> TRU
<input type="checkbox"/> Depleted Uranium	<input type="checkbox"/> Enriched Uranium	<input type="checkbox"/> _____		<input type="checkbox"/> _____		
Other Hazards						
<input type="checkbox"/>						

Completed by: Douglas Saigh Date: 07/20/11

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 8 OF 8

PPE and Monitoring Requirements

Standard PPE					
<input checked="" type="checkbox"/> Hard Hat	<input checked="" type="checkbox"/> Safety shoes	<input checked="" type="checkbox"/> Safety glasses	<input checked="" type="checkbox"/> Boot Covers	<input type="checkbox"/> Rubber Boots	<input checked="" type="checkbox"/> High Visibility Vest
Eye and Face Protection					
<input type="checkbox"/> Welding glasses	<input type="checkbox"/> Welding helmet	<input type="checkbox"/> Face shield	<input type="checkbox"/> Chemical goggles	<input type="checkbox"/> Welding screens	
Hearing Protection					
<input checked="" type="checkbox"/> Ear plugs	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Ear plugs and muffs	<input type="checkbox"/> Other _____		
Respiratory Protection					
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Upgrade Only	<input type="checkbox"/> Full Face APR	<input checked="" type="checkbox"/> Half Face APR	Cart. Type <u>asbestos</u>	<input type="checkbox"/> PAPR
<input type="checkbox"/> Airline respirator	<input type="checkbox"/> SCBA	<input type="checkbox"/> Dust mask	<input type="checkbox"/> _____		
Protective Clothing					
<input type="checkbox"/> Tyvek® coveralls	<input type="checkbox"/> Poly-coated Tyvek® Coveralls	<input type="checkbox"/> Saranex® Coveralls	<input type="checkbox"/> Fully encapsulating suit	<input type="checkbox"/> Apron	
<input type="checkbox"/> Cotton coveralls	<input type="checkbox"/> Modesty Clothing	<input type="checkbox"/> Fire resistant clothing	<input type="checkbox"/> Other _____		
Hand Protection					
<input type="checkbox"/> None	<input type="checkbox"/> Cotton gloves	<input type="checkbox"/> Leather gloves	<input type="checkbox"/> Cut-resistant gloves	<input type="checkbox"/> Glove liners	
Outer Gloves					
<input checked="" type="checkbox"/> Nitrile	<input type="checkbox"/> Viton®	<input type="checkbox"/> Butyl	<input type="checkbox"/> Neoprene	<input type="checkbox"/> Other _____	
Inner Gloves					
<input type="checkbox"/> Nitrile	<input type="checkbox"/> Vinyl	<input type="checkbox"/> Latex	<input type="checkbox"/> Other _____		
Other Required PPE					
<input type="checkbox"/> Personal Flotation Device	<input type="checkbox"/> Waders	<input type="checkbox"/> _____	<input type="checkbox"/> _____		
Monitoring Requirements					
<input type="checkbox"/> Oxygen	<input type="checkbox"/> Flammable gases/vapors	<input type="checkbox"/> Toxic Gas/vapors	<input type="checkbox"/> Hydrogen Sulfide	Carbon Monoxide	
<input type="checkbox"/> Asbestos	<input type="checkbox"/> Full time IH coverage	<input type="checkbox"/> Part time IH coverage	<input type="checkbox"/> Be, Hg, Cr, Pb		
<input type="checkbox"/> Metals Specify: _____					
<input type="checkbox"/> Organic Vapors Specify: _____					
<input type="checkbox"/> None	<input type="checkbox"/> TLD required	<input type="checkbox"/> CAM	<input type="checkbox"/> Radon		
<input type="checkbox"/> Full time RCT coverage	<input type="checkbox"/> Part time RCT coverage	<input type="checkbox"/> Radioactive air particulates	<input type="checkbox"/> Other _____		
<input checked="" type="checkbox"/> Other Monitor for nuisance dust, metals, and asbestos during major construction activity as needed					

PPE and monitoring requirements completed by: Douglas Saigh Date: 07/20/11

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 1 OF 5

Job Hazard Analysis Form

JHA No.: JHA - NOVI - 007 - 11 - 01

Job Title: Asbestos Inspections and Field Operations **Date of Analysis:** 9/15/11

Job Location: Honeywell Lake Linden-C&H Power Plant Site **Team Leader/Project Manager:** Dan Dyer

- Applicable ES&H Procedures:**
- 2.9.A - Hazardous Waste Operations and Emergency Response Program
 - 2.9.C - Respiratory Protection Program
 - 2.9.D - Personal Protective Equipment Program
 - 2.9.E - Hazard Communication Program
 - 2.9.3 - Ladders
 - 2.9.4 - Scaffolds
 - 2.9.12 - Asbestos
 - 2.14.2 - Handling, Storage, and Control of Hazardous Chemicals
 - 2.14.4 - Handling Drums and Containers
 - 2.14.5 - Collection of Field Samples

Other Referenced JHAs:

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Asbestos inspection and sampling certification requirements	1) Training requirements	<ul style="list-style-type: none"> • Only current state certified asbestos inspectors, or state-specific equivalent, will be performing asbestos inspections and sampling in general accordance with NESHAP and state regulations. • Asbestos sampling will be performed in a manner to minimize dust generation and unnecessary damage to surrounding materials. • If sampling friable material, wet methods will be used and a half mask respirator will be donned with asbestos filters. • Wet methods will at a minimal include spraying the sampling material with water several times prior to sample collection.
2. Inspection planning; Prepare for site visit(s). Check facility file in DEP database. Review potential hazards that might be encountered while visiting this facility. Identify site/activity PPE needs; Check contents of PPE equipment bag for complete inventory	2) Slips, trips and falls, heavy lifting	<ul style="list-style-type: none"> • Be aware of your surroundings. Avoid slippery floors. Review facility file. Review reference documents on the facility being inspected (if available). Familiarize self w/site prior to visit; know contaminants of concern and properties, locations of suspected contaminant areas. Complete appropriate training and identify appropriate PPE needs before inspection. Provide itinerary to supervisor, or periodically check in w/office. Prepare listing of emergency phone numbers, both on and offsite.
3. Driving/parking state vehicle	3A) Traffic accidents	<ul style="list-style-type: none"> • Always wear seat belts. Drive defensively/follow traffic regs. Perform quick vehicle inspection for obvious items such as tire inflation, wind shield wipers, sufficient gas to get to destination, observe state, federal and local guidelines for use of vehicle: make certain procedures regarding accidents, injuries, vehicular break downs or roadside emergencies are followed if necessary.
	3B) Hostile neighborhoods	<ul style="list-style-type: none"> • Be aware of surroundings. Use buddy system, when possible. Keep doors locked. Recommend carrying cellular phone. Obtain a law enforcement escort if necessary.
	3C) Road emergency/vehicle breakdown	<ul style="list-style-type: none"> • Keep vehicle maintenance up to date. Keep tools and spare tire in vehicle. Recommend carrying fire extinguisher, flashlight, battery jumper cables, first aid kit, and cellular phone in vehicle.

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2

Owner: H.J. Gordon Approver: S. D. Rima PAGE 2 OF 5

Key Work Steps	Hazards/Potential Hazards	Safe Practices
<p>4. Arrival at facility: Wear or provide proper identification</p> <p>Be aware of site security</p> <p>Assess site conditions</p> <p>Review facility contingency plan w/facility health and safety officer or equivalent.</p>	<p>4) Irritated site owner</p> <p>Dangerous surroundings</p> <p>Heat Exhaustion and Sun Exposure</p> <p>Weather conditions</p>	<ul style="list-style-type: none"> • Be courteous and diplomatic. • Do not enter site unless accompanied by another inspector or site personnel. • Identify areas where biohazards may lurk, plan escape route in advance. • Heat- Avoid dehydration. Know signs of heat stroke have fluids available at site, take frequent rest breaks. • Sun- Keep body protected wears sunscreen when not sampling, wide brimmed hat or hard hat and sunglasses. • Inclement conditions- seek covered, secure shelter • Extreme cold- layered clothing, gloves, hat, etc. • Identify any addition hazards not in Health and Safety Plan; Be familiar with escape routes and emergency procedures.
<p>5. Site inspections</p>	<p>5A) Slips, trips, falls</p> <p>Excessive noise</p> <p>*All Potential Hazard Codes are applicable</p>	<ul style="list-style-type: none"> • Wear skid-resistant soles and steel-toe shoes or boots. Use hearing protection. Be aware of surroundings (including rough terrain, construction debris, unstable ground/surfaces, etc.). Do not climb homemade ladders or unstable structures. Avoid elevated tanks, or structures, lacking adequate safety features (such as handrails and good quality ladders.). Do not enter active asbestos removal containment area without self contained breathing apparatus (SCBA) as PPE and appropriate training. Do not enter confined spaces. Active asbestos removal containment entry requires complete removal of street clothing in uncontaminated area and use of full Tyvek suit in contamination area, with appropriate safety equipment such as boots, gloves, hardhat, etc. within the containment area.
	<p>5B) Asphyxiation and/or inhalation of hazardous materials.</p>	<ul style="list-style-type: none"> • Do not enter active asbestos removal containment area without self contained breathing apparatus (SCBA) as PPE and appropriate training. If active removal area entry is necessary, the OSHA respiratory protection procedures for asbestos inspectors shall be followed. Do not enter confined spaces where toxic gases could be trapped, such as empty tanks, manholes, and chemical storage rooms (chlorine, etc.) with poor ventilation.
	<p>5C) Electrical hazards; Falling debris and low-hanging objects; Cuts/abrasion from sharp objects, debris, etc.</p>	<ul style="list-style-type: none"> • Be alert and aware of surroundings. Do not touch electrical wires (or metal surfaces in contact with wires). Wear PPE including appropriate clothing, safety boots, and gloves. Recommend Tetanus immunization.
	<p>5D) Dangerous animals and vegetation</p>	<ul style="list-style-type: none"> • Be aware of your surroundings. Learn to identify and avoid toxic plants such as poison wood trees. Watch for dangerous animals, such as dogs, raccoons, snakes and insects. Wear appropriate clothing and boots and carry mosquito repellent.
	<p>5E) Eye/skin contact with biological and chemical contaminants during inspection and sampling.</p>	<ul style="list-style-type: none"> • Minimize exposure: avoid contact with contaminated surfaces. Wear adequate PPE, such as appropriate respiratory protection, clothing, gloves, and eye protection. Carry adequate supply of clean water for washing and flushing skin and eyes. Recommend periodical medical monitoring and Hepatitis immunization.
<p>6. Unknown situation/hazard encountered</p>		<ul style="list-style-type: none"> • Halt inspection and remove self to position of safety; contact supervisor/office for guidance. If appropriate guidance is unavailable, stop inspection and return to the office. If injury has occurred, proceed to nearest emergency medical facility for treatment. Contact supervisor as soon as possible. If you believe you have been exposed to harmful levels of chemicals or physical agents, inform supervisor as soon as possible to get medical monitoring. All injuries and suspected exposures are to be reported to supervisors.

CORPORATE ES&H PROCEDURE

Issued: **1/23/06** Effective: **1/24/06** **ESH-2.9.1 REVISION 2**

Owner: **H.J. Gordon** Approver: **S. D. Rima** **PAGE 3 OF 5**

Key Work Steps	Hazards/Potential Hazards	Safe Practices
7. Site exit	7) Improper decontamination	<ul style="list-style-type: none"> • Active asbestos removal containment entry requires (COMPLIANCE WITH OSHA ASBESTOS REMOVAL STANDARDS) such as air monitoring, work enclosures, asbestos wetting (to keep down air born asbestos dust), complete removal of street clothing in uncontaminated area and use of full Tyvek suit in contamination area, with appropriate safety equipment such as boots, gloves, hardhat, respiratory protection, etc. within the containment area. Minimize exposure by avoiding contact with containment area. If entry occurs into active asbestos removal area, then all decontamination procedures must be followed. These procedures should include: proper decontamination and/or disposal of contaminated safety clothing; cleaning of PPE equipment; and shower before exiting the containment area. Update exposure log.
8. Drive to office or next site for inspection	8) Traffic hazards	<ul style="list-style-type: none"> • Follow "Driving/Parking state/federal and local Vehicle laws.
9. Record Inspection activities	9) Slips, trips and falls Repetitive Motion	<ul style="list-style-type: none"> • Be aware of your surroundings. Avoid slippery floors and repetitive motions. • Review facility. Review reference documents and notes on the inspected facility (if available). Enter compliance information into Asbestos Database.

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 4 OF 5

Identify Hazards and PPE

Complete the checklists for hazard identification and PPE requirements. Information from the RA and applicable permits are included in this section.

Standard Hazards						
<input type="checkbox"/> Falling Objects	<input type="checkbox"/> Slips and trips	<input type="checkbox"/> Pinch points	<input type="checkbox"/> Rotating equipment			
<input type="checkbox"/> Falls	<input type="checkbox"/> Power equipment/tools	<input type="checkbox"/> Elevated work surfaces	<input type="checkbox"/> _____			
Eye Hazards						
<input type="checkbox"/> Particulates	<input type="checkbox"/> Liquid splashes	<input type="checkbox"/> Welding Arc	<input type="checkbox"/> _____			
Hearing Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Impact noise	<input type="checkbox"/> High frequency noise	<input type="checkbox"/> High ambient noise			
Respiratory Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Dust/particulates	<input type="checkbox"/> Organic Vapors	<input type="checkbox"/> Acid Gases	<input type="checkbox"/> Radon	<input type="checkbox"/> Asbestos	<input type="checkbox"/> Be, Hg, Cr, Pb
<input type="checkbox"/> Oxygen deficient	<input type="checkbox"/> Welding fumes	<input type="checkbox"/> Aerosols/Particulates	<input type="checkbox"/> _____			
Chemical Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Organic solvents	<input type="checkbox"/> Reactive metals	<input type="checkbox"/> PCBs			
<input type="checkbox"/> Acids / bases	<input type="checkbox"/> Oxidizers	<input type="checkbox"/> Volatiles / Semi-volatiles	<input type="checkbox"/> _____			
Environmental Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Temperature extremes: <input type="checkbox"/> Cold <input type="checkbox"/> Heat	<input type="checkbox"/> Wet location	<input type="checkbox"/> Explosive vapors	<input type="checkbox"/> Confined space	<input type="checkbox"/> Engulfment Hazard	
<input type="checkbox"/> Bio hazards (poisonous plants, insects, animals, animal droppings, mold, fungus, etc.)				<input type="checkbox"/> _____		
Electrical Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Overhead utilities	<input type="checkbox"/> Underground utilities	<input type="checkbox"/> Hidden utilities	<input type="checkbox"/> Energized equip/circuits	<input type="checkbox"/> Wet location	
Fire Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Cutting, welding, or grinding generated sparks or heat sources	<input type="checkbox"/> Flammable materials present	<input type="checkbox"/> Oxygen enriched location			
Ergonomic Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Lifting	<input type="checkbox"/> Bending	<input type="checkbox"/> Twisting	<input type="checkbox"/> Pulling/tugging	<input type="checkbox"/> Repetitive motion	
Computer Use in the:	<input type="checkbox"/> Office	<input type="checkbox"/> Field	<input type="checkbox"/> _____			
Radiological Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Loose contamination	<input type="checkbox"/> Fixed Contamination	<input type="checkbox"/> Airborne contamination	<input type="checkbox"/> Radiation	<input type="checkbox"/> Radon	
<input type="checkbox"/> Alpha	<input type="checkbox"/> Beta	<input type="checkbox"/> Gamma/X-rays	<input type="checkbox"/> Neutron	<input type="checkbox"/> EMF	<input type="checkbox"/> Criticality	<input type="checkbox"/> Tritium <input type="checkbox"/> TRU
<input type="checkbox"/> Depleted Uranium	<input type="checkbox"/> Enriched Uranium	<input type="checkbox"/> _____		<input type="checkbox"/> _____		
Other Hazards						
<input type="checkbox"/>						

Completed by: _____ Date: _____

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 5 OF 5

PPE and Monitoring Requirements

Standard PPE					
<input type="checkbox"/> Hard Hat	<input type="checkbox"/> Safety shoes	<input type="checkbox"/> Safety glasses	<input type="checkbox"/> Boot Covers	<input type="checkbox"/> Rubber Boots	<input type="checkbox"/> High Visibility Vest
Eye and Face Protection					
<input type="checkbox"/> Welding glasses	<input type="checkbox"/> Welding helmet	<input type="checkbox"/> Face shield	<input type="checkbox"/> Chemical goggles	<input type="checkbox"/> Welding screens	
Hearing Protection					
<input type="checkbox"/> Ear plugs	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Ear plugs and muffs	<input type="checkbox"/> Other _____		
Respiratory Protection					
<input type="checkbox"/> None	<input type="checkbox"/> Upgrade Only	<input type="checkbox"/> Full Face APR	<input type="checkbox"/> Half Face APR	Cart. Type _____	<input type="checkbox"/> PAPR
<input type="checkbox"/> Airline respirator	<input type="checkbox"/> SCBA	<input type="checkbox"/> Dust mask	<input type="checkbox"/> _____		
Protective Clothing					
<input type="checkbox"/> Tyvek® coveralls	<input type="checkbox"/> Poly-coated Tyvek® Coveralls	<input type="checkbox"/> Saranex® Coveralls	<input type="checkbox"/> Fully encapsulating suit	<input type="checkbox"/> Apron	
<input type="checkbox"/> Cotton coveralls	<input type="checkbox"/> Modesty Clothing	<input type="checkbox"/> Fire resistant clothing	<input type="checkbox"/> Other _____		
Hand Protection					
<input type="checkbox"/> None	<input type="checkbox"/> Cotton gloves	<input type="checkbox"/> Leather gloves	<input type="checkbox"/> Cut-resistant gloves	<input type="checkbox"/> Glove liners	
Outer Gloves					
<input type="checkbox"/> Nitrile	<input type="checkbox"/> Viton®	<input type="checkbox"/> Butyl	<input type="checkbox"/> Neoprene	<input type="checkbox"/> Other _____	
Inner Gloves					
<input type="checkbox"/> Nitrile	<input type="checkbox"/> Vinyl	<input type="checkbox"/> Latex	<input type="checkbox"/> Other _____		
Other Required PPE					
<input type="checkbox"/> Personal Flotation Device	<input type="checkbox"/> Waders _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____		
Monitoring Requirements					
<input type="checkbox"/> Oxygen	<input type="checkbox"/> Flammable gases/vapors	<input type="checkbox"/> Toxic Gas/vapors	<input type="checkbox"/> Hydrogen Sulfide	<input type="checkbox"/> Carbon Monoxide	
<input type="checkbox"/> Asbestos	<input type="checkbox"/> Full time IH coverage	<input type="checkbox"/> Part time IH coverage	<input type="checkbox"/> Be, Hg, Cr, Pb		
<input type="checkbox"/> Metals Specify: _____					
<input type="checkbox"/> Organic Vapors Specify: _____					
<input type="checkbox"/> None	<input type="checkbox"/> TLD required	<input type="checkbox"/> CAM	<input type="checkbox"/> Radon		
<input type="checkbox"/> Full time RCT coverage	<input type="checkbox"/> Part time RCT coverage	<input type="checkbox"/> Radioactive air particulates	<input type="checkbox"/> Other _____		
<input type="checkbox"/> Other _____		<input type="checkbox"/> Other _____			

PPE and monitoring requirements completed by: _____ Date: _____

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 1 OF 9

Job Hazard Analysis Form

JHA No.: JHA - NOVI - 008 - 11 - 01

Job Title: Fence Installation/Repair **Date of Analysis:** 9/28/11

Job Location: Honeywell Lake Linden-C&H Power Plant Site **Team Leader/Project Manager:** Dan Dyer

- Applicable ES&H Procedures:**
- 2.9.A - Hazardous Waste Operations and Emergency Response Program
 - 2.9.D - Personal Protective Equipment Program
 - 2.9.E - Hazard Communication Program
 - 2.5.1 - Operation of Company Vehicles and Use of Personal Vehicles on Company Business
 - 2.9.7 - Overhead and Underground Utilities
 - 2.9.21 - Power and Hand Tools
 - 2.13.1 - Medical Surveillance
 - 2.13.2 - Medical Emergencies and First Aid

Other Referenced JHAs:

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Prepare for installation	1A) Chemical exposure	1A) Chemical Exposure <ul style="list-style-type: none"> ▪ Read HASP and determine air monitoring and PPE needs.
2. Mobilization / Demobilization and Site Preparation	2A) See Mobilization / Demobilization and Site Preparation JHA	2A) See Mobilization/Demobilization and Site Preparation JHA
3. Calibrate monitoring equipment	3A) Exposure to calibration gases	3A) Exposure to calibration gases <ul style="list-style-type: none"> ▪ Review equipment manuals ▪ Calibrate in a clean, well ventilated area
4. Working near roadway	4A) Struck by moving vehicles	4A) Struck by moving vehicles <ul style="list-style-type: none"> ▪ Wear high visibility vest at all times ▪ Stay alert and aware of traffic ▪ Use cones and warning signs if required
5. Carrying equipment to site location	5A) Cuts (from tools and wire)	5A) Cuts (from tools and wire) <ul style="list-style-type: none"> ▪ Cover blades or sharp ends of equipment or tools while carrying or transporting.
	5B) Slips, trips, falls	5B) Slips, trips, falls <ul style="list-style-type: none"> ▪ Survey and clear the pathway. See JHA for Clearing Brush and Trees
	5C) Back or muscle strain	5C) Back or muscle strain <ul style="list-style-type: none"> ▪ Use proper lifting techniques when lifting equipment ▪ Use mechanical aids if available ▪ Use 2 person lift for heavy items

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2

Owner: H.J. Gordon Approver: S. D. Rima PAGE 2 OF 9

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	5D) Exposure to hazardous Inhalation and contact with hazardous substances (lead contaminated soil); flammable atmospheres.	5D) Exposure to hazardous substances <ul style="list-style-type: none"> ▪ Wear PPE as identified in HASP. ▪ Review hazardous properties of site contaminants with workers before sampling operations begin ▪ Monitor breathing zone air in accordance with HASP to determine levels of contaminants present. ▪ When decontaminating equipment wear additional eye/face protection over the safety glasses such as a face shield.
	5E) Foot injuries from dropped equipment	5E) Foot Injuries <ul style="list-style-type: none"> ▪ Be aware when moving objects, ensure you have a good grip when lifting and carrying objects. ▪ Do not carry more than you can handle safely ▪ Wear steel toed boots
6. Preparing work location	6A) Contact with poisonous plants or the oil from poisonous plants	6A) Contact with poisonous plants or the oil from those plants: <ul style="list-style-type: none"> ▪ Look for signs of poisonous plants and avoid. ▪ Wear PPE as described in the HASP. ▪ Do not touch anything part of your body/clothing. ▪ Always wash gloves before removing them. ▪ Discard PPE in accordance with the HASP. ▪ If contact with poisonous plants is likely, see JHA Poisonous Plants
	6B) Contact with biting insects (i.e., spiders, bees, etc.)	6B) Contact with stinging/biting insects <ul style="list-style-type: none"> ▪ Discuss the types of insects expected at the Site and be able to identify them. ▪ Look for signs of insects in and around the well. ▪ Wear Level of PPE as described in the HASP. At a minimum, follow guidelines in the JHA "Insects Stings and Bites." ▪ If necessary, wear protective netting over your head/face. ▪ Avoid contact with the insects if possible. ▪ Inform your supervisor and the Site Health and Safety Supervisor if you have any allergies to insects and insect bites. Make sure you have identification of your allergies with you at all times and appropriate response kits if applicable. ▪ Get medical help immediately if you are bitten by a black widow or brown recluse, or if you have a severe reaction to any spider bite or bee sting.
	6C) Exposure to hazardous Inhalation and contact with hazardous substances (lead contaminated soil); flammable atmospheres.	6C) Exposure to hazardous substances <ul style="list-style-type: none"> ▪ Wear PPE as identified in HASP. ▪ Review hazardous properties of site contaminants with workers before sampling operations begin ▪ Monitor breathing zone air in accordance with HASP to determine levels of contaminants present. ▪ When decontaminating equipment wear additional eye/face protection over the safety glasses such as a face shield.
	6D) Cuts (from tools and wire)	6D) Cuts (from tools and wire) <ul style="list-style-type: none"> ▪ Clear work area of limbs, rocks, debris before working ▪ Maintain 10 feet of spacing between workers when using cutting tools ▪ If cutting wire, confine both ends of wires to be cut, don't let wire fly around uncontrolled. ▪ Keep all cuts and scratches clean and obtain first aid for even the small injuries

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2

Owner: H.J. Gordon Approver: S. D. Rima PAGE 3 OF 9

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	6E) Back strain due to lifting or moving equipment	6E) Back strain <ul style="list-style-type: none"> ▪ Use mechanical aids when possible, if mechanical aids are not available, use two person lifts for heavy items. ▪ Use proper lifting techniques
	6F) Foot injuries from dropped equipment	6F) Foot Injuries <ul style="list-style-type: none"> ▪ Be aware when moving objects, ensure you have a good grip when lifting and carrying objects. ▪ Do not carry more than you can handle safely ▪ Wear steel toed boots
	6G) Underground or overhead Utilities	6G) Underground utilities <ul style="list-style-type: none"> ▪ Work at adequate offsets from utility locations ▪ For areas where utility locations cannot be verified, workers must hand dig for the first 3 feet ▪ Immediately cease work if unknown utility markings are discovered. ▪ Conform to utility clearances based on voltage of lines. For powerlines of 50 KV or less stay at least 10 feet away. For powerlines of > 50 KV, add an additional 0.4 inches per KV over 50 KV. Rule of thumb: Stay 10 feet away if powerline known to be 50 KV or less. Stay 35 feet away for lines > 50 KV or if voltage is unknown.
7. Vegetation Removal	7A) Abrasions and blisters	7A) Abrasions and blisters <ul style="list-style-type: none"> ▪ Use leather gloves. If contact with contaminants is a potential, wear with chemical resistant gloves.
	7B) Strains to dragging and lifting brush/debris	7B) Strains to dragging and lifting brush/debris <ul style="list-style-type: none"> ▪ Do flexing and stretching exercises prior to dragging/lifting to warm up muscles. ▪ Use proper bending and lifting techniques
	7C) Injury from chain saw	7C) See Chain Saw Operation JHA
8. Marking Fence Line	8A) Abrasions and blisters	8A) Abrasions and blisters <ul style="list-style-type: none"> ▪ Use leather gloves. If contact with contaminants is a potential, wear with chemical resistant gloves.
	8B) Strains due to using sledge hammer	8B) Strains due to using sledge hammer <ul style="list-style-type: none"> ▪ Make sure proper and secure footing is established prior to swinging sledge hammer ▪ Make sure no people or obstructions are within the swing distance of the sledge hammer ▪ Wear proper safety glasses to protect eyes from splintering objects ▪ Keep feet shoulder width apart and bend slightly at the knees during when swinging sledge hammer ▪ Only swing sledge hammer from above your head downwards to the target in front of you
9. Drilling and Setting Terminal Fence Posts	9A) Operation of skid-steer mounted auger	<ul style="list-style-type: none"> • Operating a skid-steer mounted auger <ul style="list-style-type: none"> ▪ Stay alert. Maintain a 10-foot radius from the skid-steer during operation ▪ Wear proper safety glasses. ▪ Do not approach the digging area until the auger has ceased to operate

CORPORATE ESH&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2

Owner: H.J. Gordon Approver: S. D. Rima PAGE 4 OF 9

Key Work Steps	Hazards/Potential Hazards	Safe Practices
10. Setting Line Posts	9B) Operation of air powered pounder	<ul style="list-style-type: none"> • Operating a air powered pounder <ul style="list-style-type: none"> • Stay alert. Maintain a 5-foot radius from the operator of the air pounder • Wear proper safety glasses. • Check that area is clear of all personnel before setting and operating the air pounder • Wear proper air plugs
11. Handling fence	9C) Cuts (from fence, tools and wire)	<ul style="list-style-type: none"> • Cuts (from fence, tools and wire) <ul style="list-style-type: none"> ▪ Stay alert. Wear long sleeved shirts, long pants, leather gloves, safety glasses and steel toed boots ▪ Maintain 10 feet of spacing between workers when using cutting tools ▪ If cutting wire, confine both ends of wires to be cut, don't let wire fly around uncontrolled. ▪ Keep all cuts and scratches clean and obtain first aid for even the small injuries
	9D) Stains due to lifting and moving fence and footing	<ul style="list-style-type: none"> • Get help lifting and moving fence and footing
12. Exposure to the environment	10A) Thunderstorms	<p>10A) Thunderstorms</p> <ul style="list-style-type: none"> ▪ Monitor weather channels to determine if electrical storms are forecasted. ▪ Plan ahead and identify safe locations to be in the event of a storm. (e.g., sturdy building, vehicle, etc.) ▪ Suspend all field work at the first sound of thunder. You should be in a safe place when the time between the lightning and thunder is less than 30 seconds. ▪ Only return to work 30 minutes after the after the last strike or sound of thunder ▪ Stay well away from metal fence in a thunderstorm
	10B) Wind storms	<p>10B) Effects of the wind</p> <ul style="list-style-type: none"> ▪ Wind chill greatly affects heat loss (see attached Wind Chill Index). ▪ Avoid marking in old, defective timber, especially hardwoods, during periods of high winds due to snag hazards.
	10C) Cold Extremes	<p>10C) Take precautions to prevent cold stress injuries</p> <ul style="list-style-type: none"> ▪ Cover all exposed skin and be aware of frostbite. While cold air will not freeze the tissues of the lungs, slow down and use a mask or scarf to minimize the effect of cold air on air passages. ▪ Dress in layers with wicking garments (those that carry moisture away from the body – e.g., cotton) and a weatherproof slicker. A wool outer garment is recommended. ▪ Take layers off as you heat up; put them on as you cool down. ▪ Wear head protection that provides adequate insulation and protects the ears. ▪ Maintain your energy level. Avoid exhaustion and over-exertion which causes sweating, dampens clothing, and accelerates loss of body heat and increases the potential for hypothermia. ▪ Acclimate to the cold climate to minimize discomfort. ▪ Maintain adequate water/fluid intake to avoid dehydration.

CORPORATE ES&H PROCEDURE

Issued: **1/23/06** Effective: **1/24/06** **ESH-2.9.1 REVISION 2**
 Owner: **H.J. Gordon** Approver: **S. D. Rima** **PAGE 5 OF 9**

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	10D) Heat Stress	10D) Take precautions to prevent heat stress <ul style="list-style-type: none"> ▪ Remain constantly aware of the four basic factors that determine the degree of heat stress (air temperature, humidity, air movement, and heat radiation) relative to the surrounding work environmental heat load. ▪ Know the signs and symptoms of heat exhaustion, heat cramps, and heat stroke. Heat stroke is a true medical emergency requiring immediate emergency response action. <p>NOTE: The severity of the effects of a given environmental heat stress is decreased by reducing the work load, increasing the frequency and/or duration of rest periods, and by introducing measures which will protect employees from hot environments.</p> <ul style="list-style-type: none"> ▪ Maintain adequate water intake by drinking water periodically in small amounts throughout the day (flavoring water with citrus flavors or extracts enhances palatability). ▪ Allow approximately 2 weeks with progressive degrees of heat exposure and physical exertion for substantial acclimatization. ▪ Acclimatization is necessary regardless of an employee's physical condition (the better one's physical condition, the quicker the acclimatization). Tailor the work schedule to fit the climate, the physical condition of employees, and mission requirements. <ul style="list-style-type: none"> ▪ A reduction of work load markedly decreases total heat stress. ▪ Lessen work load and/or duration of physical exertion the first days of heat exposure to allow gradual acclimatization. ▪ Alternate work and rest periods. More severe conditions may require longer rest periods and electrolyte fluid replacement.

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 6 OF 9

Identify Hazards and PPE

Complete the checklists for hazard identification and PPE requirements. Information from the RA and applicable permits are included in this section.

Standard Hazards						
<input type="checkbox"/> Falling Objects	<input checked="" type="checkbox"/> Slips and trips	<input checked="" type="checkbox"/> Pinch points	<input type="checkbox"/> Rotating equipment			
<input type="checkbox"/> Falls	<input checked="" type="checkbox"/> Power equipment/tools	<input type="checkbox"/> Elevated work surfaces	<input type="checkbox"/> _____			
Eye Hazards						
<input checked="" type="checkbox"/> Particulates	<input type="checkbox"/> Liquid splashes	<input type="checkbox"/> Welding Arc	<input checked="" type="checkbox"/> Trees, branches, wire			
Hearing Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Impact noise	<input type="checkbox"/> High frequency noise	<input type="checkbox"/> High ambient noise			
Respiratory Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Dust/particulates	<input type="checkbox"/> Organic Vapors	<input type="checkbox"/> Acid Gases	<input type="checkbox"/> Radon	<input type="checkbox"/> Asbestos	<input type="checkbox"/> Be, Hg, Cr, Pb
<input type="checkbox"/> Oxygen deficient	<input type="checkbox"/> Welding fumes	<input type="checkbox"/> Aerosols/Particulates	<input type="checkbox"/> _____			
Chemical Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Organic solvents	<input type="checkbox"/> Reactive metals	<input type="checkbox"/> PCBs			
<input type="checkbox"/> Acids / bases	<input type="checkbox"/> Oxidizers	<input checked="" type="checkbox"/> Volatiles / Semi-volatiles	<input type="checkbox"/> _____			
Environmental Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Temperature extremes: <input checked="" type="checkbox"/> Cold <input checked="" type="checkbox"/> Heat	<input type="checkbox"/> Wet location	<input type="checkbox"/> Explosive vapors	<input type="checkbox"/> Confined space	<input type="checkbox"/> Engulfment Hazard	
<input checked="" type="checkbox"/> Bio hazards (poisonous plants, insects, animals, animal droppings, mold, fungus, etc.)					<input type="checkbox"/> _____	
Electrical Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Overhead utilities	<input type="checkbox"/> Underground utilities	<input type="checkbox"/> Hidden utilities	<input type="checkbox"/> Energized equip/circuits	<input type="checkbox"/> Wet location	
Fire Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cutting, welding, or grinding generated sparks or heat sources	<input type="checkbox"/> Flammable materials present	<input type="checkbox"/> Oxygen enriched location			
Ergonomic Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Lifting	<input type="checkbox"/> Bending	<input checked="" type="checkbox"/> Twisting	<input checked="" type="checkbox"/> Pulling/tugging	<input type="checkbox"/> Repetitive motion	
Computer Use in the:	<input type="checkbox"/> Office	<input type="checkbox"/> Field	<input checked="" type="checkbox"/> Shoveling			
Radiological Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Loose contamination	<input type="checkbox"/> Fixed Contamination	<input type="checkbox"/> Airborne contamination	<input type="checkbox"/> Radiation	<input type="checkbox"/> Radon	
<input type="checkbox"/> Alpha	<input type="checkbox"/> Beta	<input type="checkbox"/> Gamma/X-rays	<input type="checkbox"/> Neutron	<input type="checkbox"/> EMF	<input type="checkbox"/> Criticality	<input type="checkbox"/> Tritium <input type="checkbox"/> TRU
<input type="checkbox"/> Depleted Uranium	<input type="checkbox"/> Enriched Uranium	<input type="checkbox"/> _____		<input type="checkbox"/> _____		
Other Hazards						
<input type="checkbox"/>						

Completed by: _____ Date: _____

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 7 OF 9

PPE and Monitoring Requirements

Standard PPE					
<input checked="" type="checkbox"/> Hard Hat	<input checked="" type="checkbox"/> Safety shoes	<input checked="" type="checkbox"/> Safety glasses	<input type="checkbox"/> Boot Covers	<input type="checkbox"/> Rubber Boots	<input checked="" type="checkbox"/> High Visibility Vest
Eye and Face Protection					
<input type="checkbox"/> Welding glasses	<input type="checkbox"/> Welding helmet	<input type="checkbox"/> Face shield	<input type="checkbox"/> Chemical goggles	<input type="checkbox"/> Welding screens	
Hearing Protection					
<input type="checkbox"/> Ear plugs	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Ear plugs and muffs	<input type="checkbox"/> Other _____		
Respiratory Protection					
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Upgrade Only	<input type="checkbox"/> Full Face APR	<input type="checkbox"/> Half Face APR	Cart. Type _____	<input type="checkbox"/> PAPR
<input type="checkbox"/> Airline respirator	<input type="checkbox"/> SCBA	<input type="checkbox"/> Dust mask	<input type="checkbox"/> _____		
Protective Clothing					
<input type="checkbox"/> Tyvek® coveralls	<input type="checkbox"/> Poly-coated Tyvek® Coveralls	<input type="checkbox"/> Saranex® Coveralls	<input type="checkbox"/> Fully encapsulating suit	<input type="checkbox"/> Apron	
<input type="checkbox"/> Cotton coveralls	<input type="checkbox"/> Modesty Clothing	<input type="checkbox"/> Fire resistant clothing	<input type="checkbox"/> Other _____		
Hand Protection					
<input type="checkbox"/> None	<input type="checkbox"/> Cotton gloves	<input checked="" type="checkbox"/> Leather gloves	<input type="checkbox"/> Cut-resistant gloves	<input type="checkbox"/> Glove liners	
Outer Gloves					
<input type="checkbox"/> Nitrile	<input type="checkbox"/> Viton®	<input type="checkbox"/> Butyl	<input type="checkbox"/> Neoprene	<input type="checkbox"/> Other _____	
Inner Gloves					
<input type="checkbox"/> Nitrile	<input type="checkbox"/> Vinyl	<input type="checkbox"/> Latex	<input type="checkbox"/> Other _____		
Other Required PPE					
<input type="checkbox"/> Personal Flotation Device	<input type="checkbox"/> Waders _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____		
Monitoring Requirements					
<input type="checkbox"/> Oxygen	<input type="checkbox"/> Flammable gases/vapors	<input checked="" type="checkbox"/> Toxic Gas/vapors	<input type="checkbox"/> Hydrogen Sulfide	Carbon Monoxide	
<input type="checkbox"/> Asbestos	<input type="checkbox"/> Full time IH coverage	<input type="checkbox"/> Part time IH coverage	<input type="checkbox"/> Be, Hg, Cr, Pb		
<input type="checkbox"/> Metals Specify: _____					
<input checked="" type="checkbox"/> Organic Vapors Specify: _____					
<input type="checkbox"/> None	<input type="checkbox"/> TLD required	<input type="checkbox"/> CAM	<input type="checkbox"/> Radon		
<input type="checkbox"/> Full time RCT coverage	<input type="checkbox"/> Part time RCT coverage	<input type="checkbox"/> Radioactive air particulates	<input type="checkbox"/> Other _____		
<input type="checkbox"/> Other _____		<input type="checkbox"/> Other _____			

PPE and monitoring requirements completed by: _____ Date: _____

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 1 OF 9

Job Hazard Analysis Form

JHA No.: JHA - NOVI - 008 - 11 - 01

Job Title: Fence Installation/Repair **Date of Analysis:** 9/28/11

Job Location: Honeywell Lake Linden-C&H Power Plant Site **Team Leader/Project Manager:** Dan Dyer

- Applicable ES&H Procedures:**
- 2.9.A - Hazardous Waste Operations and Emergency Response Program
 - 2.9.D - Personal Protective Equipment Program
 - 2.9.E - Hazard Communication Program
 - 2.5.1 - Operation of Company Vehicles and Use of Personal Vehicles on Company Business
 - 2.9.7 - Overhead and Underground Utilities
 - 2.9.21 - Power and Hand Tools
 - 2.13.1 - Medical Surveillance
 - 2.13.2 - Medical Emergencies and First Aid

Other Referenced JHAs:

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Prepare for installation	1A) Chemical exposure	1A) Chemical Exposure <ul style="list-style-type: none"> ▪ Read HASP and determine air monitoring and PPE needs.
2. Mobilization / Demobilization and Site Preparation	2A) See Mobilization / Demobilization and Site Preparation JHA	2A) See Mobilization/Demobilization and Site Preparation JHA
3. Calibrate monitoring equipment	3A) Exposure to calibration gases	3A) Exposure to calibration gases <ul style="list-style-type: none"> ▪ Review equipment manuals ▪ Calibrate in a clean, well ventilated area
4. Working near roadway	4A) Struck by moving vehicles	4A) Struck by moving vehicles <ul style="list-style-type: none"> ▪ Wear high visibility vest at all times ▪ Stay alert and aware of traffic ▪ Use cones and warning signs if required
5. Carrying equipment to site location	5A) Cuts (from tools and wire)	5A) Cuts (from tools and wire) <ul style="list-style-type: none"> ▪ Cover blades or sharp ends of equipment or tools while carrying or transporting.
	5B) Slips, trips, falls	5B) Slips, trips, falls <ul style="list-style-type: none"> ▪ Survey and clear the pathway. See JHA for Clearing Brush and Trees
	5C) Back or muscle strain	5C) Back or muscle strain <ul style="list-style-type: none"> ▪ Use proper lifting techniques when lifting equipment ▪ Use mechanical aids if available ▪ Use 2 person lift for heavy items

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2

Owner: H.J. Gordon Approver: S. D. Rima PAGE 2 OF 9

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	5D) Exposure to hazardous Inhalation and contact with hazardous substances (lead contaminated soil); flammable atmospheres.	5D) Exposure to hazardous substances <ul style="list-style-type: none"> ▪ Wear PPE as identified in HASP. ▪ Review hazardous properties of site contaminants with workers before sampling operations begin ▪ Monitor breathing zone air in accordance with HASP to determine levels of contaminants present. ▪ When decontaminating equipment wear additional eye/face protection over the safety glasses such as a face shield.
	5E) Foot injuries from dropped equipment	5E) Foot Injuries <ul style="list-style-type: none"> ▪ Be aware when moving objects, ensure you have a good grip when lifting and carrying objects. ▪ Do not carry more than you can handle safely ▪ Wear steel toed boots
6. Preparing work location	6A) Contact with poisonous plants or the oil from poisonous plants	6A) Contact with poisonous plants or the oil from those plants: <ul style="list-style-type: none"> ▪ Look for signs of poisonous plants and avoid. ▪ Wear PPE as described in the HASP. ▪ Do not touch anything part of your body/clothing. ▪ Always wash gloves before removing them. ▪ Discard PPE in accordance with the HASP. ▪ If contact with poisonous plants is likely, see JHA Poisonous Plants
	6B) Contact with biting insects (i.e., spiders, bees, etc.)	6B) Contact with stinging/biting insects <ul style="list-style-type: none"> ▪ Discuss the types of insects expected at the Site and be able to identify them. ▪ Look for signs of insects in and around the well. ▪ Wear Level of PPE as described in the HASP. At a minimum, follow guidelines in the JHA "Insects Stings and Bites." ▪ If necessary, wear protective netting over your head/face. ▪ Avoid contact with the insects if possible. ▪ Inform your supervisor and the Site Health and Safety Supervisor if you have any allergies to insects and insect bites. Make sure you have identification of your allergies with you at all times and appropriate response kits if applicable. ▪ Get medical help immediately if you are bitten by a black widow or brown recluse, or if you have a severe reaction to any spider bite or bee sting.
	6C) Exposure to hazardous Inhalation and contact with hazardous substances (lead contaminated soil); flammable atmospheres.	6C) Exposure to hazardous substances <ul style="list-style-type: none"> ▪ Wear PPE as identified in HASP. ▪ Review hazardous properties of site contaminants with workers before sampling operations begin ▪ Monitor breathing zone air in accordance with HASP to determine levels of contaminants present. ▪ When decontaminating equipment wear additional eye/face protection over the safety glasses such as a face shield.
	6D) Cuts (from tools and wire)	6D) Cuts (from tools and wire) <ul style="list-style-type: none"> ▪ Clear work area of limbs, rocks, debris before working ▪ Maintain 10 feet of spacing between workers when using cutting tools ▪ If cutting wire, confine both ends of wires to be cut, don't let wire fly around uncontrolled. ▪ Keep all cuts and scratches clean and obtain first aid for even the small injuries

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2

Owner: H.J. Gordon Approver: S. D. Rima PAGE 3 OF 9

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	6E) Back strain due to lifting or moving equipment	6E) Back strain <ul style="list-style-type: none"> ▪ Use mechanical aids when possible, if mechanical aids are not available, use two person lifts for heavy items. ▪ Use proper lifting techniques
	6F) Foot injuries from dropped equipment	6F) Foot Injuries <ul style="list-style-type: none"> ▪ Be aware when moving objects, ensure you have a good grip when lifting and carrying objects. ▪ Do not carry more than you can handle safely ▪ Wear steel toed boots
	6G) Underground or overhead Utilities	6G) Underground utilities <ul style="list-style-type: none"> ▪ Work at adequate offsets from utility locations ▪ For areas where utility locations cannot be verified, workers must hand dig for the first 3 feet ▪ Immediately cease work if unknown utility markings are discovered. ▪ Conform to utility clearances based on voltage of lines. For powerlines of 50 KV or less stay at least 10 feet away. For powerlines of > 50 KV, add an additional 0.4 inches per KV over 50 KV. Rule of thumb: Stay 10 feet away if powerline known to be 50 KV or less. Stay 35 feet away for lines > 50 KV or if voltage is unknown.
7. Vegetation Removal	7A) Abrasions and blisters	7A) Abrasions and blisters <ul style="list-style-type: none"> ▪ Use leather gloves. If contact with contaminants is a potential, wear with chemical resistant gloves.
	7B) Strains to dragging and lifting brush/debris	7B) Strains to dragging and lifting brush/debris <ul style="list-style-type: none"> ▪ Do flexing and stretching exercises prior to dragging/lifting to warm up muscles. ▪ Use proper bending and lifting techniques
	7C) Injury from chain saw	7C) See Chain Saw Operation JHA
8. Marking Fence Line	8A) Abrasions and blisters	8A) Abrasions and blisters <ul style="list-style-type: none"> ▪ Use leather gloves. If contact with contaminants is a potential, wear with chemical resistant gloves.
	8B) Strains due to using sledge hammer	8B) Strains due to using sledge hammer <ul style="list-style-type: none"> ▪ Make sure proper and secure footing is established prior to swinging sledge hammer ▪ Make sure no people or obstructions are within the swing distance of the sledge hammer ▪ Wear proper safety glasses to protect eyes from splintering objects ▪ Keep feet shoulder width apart and bend slightly at the knees during when swinging sledge hammer ▪ Only swing sledge hammer from above your head downwards to the target in front of you
9. Drilling and Setting Terminal Fence Posts	9A) Operation of skid-steer mounted auger	<ul style="list-style-type: none"> • Operating a skid-steer mounted auger <ul style="list-style-type: none"> ▪ Stay alert. Maintain a 10-foot radius from the skid-steer during operation ▪ Wear proper safety glasses. ▪ Do not approach the digging area until the auger has ceased to operate

CORPORATE ESH&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2

Owner: H.J. Gordon Approver: S. D. Rima PAGE 4 OF 9

Key Work Steps	Hazards/Potential Hazards	Safe Practices
10. Setting Line Posts	9B) Operation of air powered pounder	<ul style="list-style-type: none"> • Operating a air powered pounder <ul style="list-style-type: none"> • Stay alert. Maintain a 5-foot radius from the operator of the air pounder • Wear proper safety glasses. • Check that area is clear of all personnel before setting and operating the air pounder • Wear proper air plugs
11. Handling fence	9C) Cuts (from fence, tools and wire)	<ul style="list-style-type: none"> • Cuts (from fence, tools and wire) <ul style="list-style-type: none"> ▪ Stay alert. Wear long sleeved shirts, long pants, leather gloves, safety glasses and steel toed boots ▪ Maintain 10 feet of spacing between workers when using cutting tools ▪ If cutting wire, confine both ends of wires to be cut, don't let wire fly around uncontrolled. ▪ Keep all cuts and scratches clean and obtain first aid for even the small injuries
	9D) Stains due to lifting and moving fence and footing	<ul style="list-style-type: none"> • Get help lifting and moving fence and footing
12. Exposure to the environment	10A) Thunderstorms	<p>10A) Thunderstorms</p> <ul style="list-style-type: none"> ▪ Monitor weather channels to determine if electrical storms are forecasted. ▪ Plan ahead and identify safe locations to be in the event of a storm. (e.g., sturdy building, vehicle, etc.) ▪ Suspend all field work at the first sound of thunder. You should be in a safe place when the time between the lightning and thunder is less than 30 seconds. ▪ Only return to work 30 minutes after the after the last strike or sound of thunder ▪ Stay well away from metal fence in a thunderstorm
	10B) Wind storms	<p>10B) Effects of the wind</p> <ul style="list-style-type: none"> ▪ Wind chill greatly affects heat loss (see attached Wind Chill Index). ▪ Avoid marking in old, defective timber, especially hardwoods, during periods of high winds due to snag hazards.
	10C) Cold Extremes	<p>10C) Take precautions to prevent cold stress injuries</p> <ul style="list-style-type: none"> ▪ Cover all exposed skin and be aware of frostbite. While cold air will not freeze the tissues of the lungs, slow down and use a mask or scarf to minimize the effect of cold air on air passages. ▪ Dress in layers with wicking garments (those that carry moisture away from the body – e.g., cotton) and a weatherproof slicker. A wool outer garment is recommended. ▪ Take layers off as you heat up; put them on as you cool down. ▪ Wear head protection that provides adequate insulation and protects the ears. ▪ Maintain your energy level. Avoid exhaustion and over-exertion which causes sweating, dampens clothing, and accelerates loss of body heat and increases the potential for hypothermia. ▪ Acclimate to the cold climate to minimize discomfort. ▪ Maintain adequate water/fluid intake to avoid dehydration.

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 5 OF 9

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	10D) Heat Stress	10D) Take precautions to prevent heat stress <ul style="list-style-type: none"> ▪ Remain constantly aware of the four basic factors that determine the degree of heat stress (air temperature, humidity, air movement, and heat radiation) relative to the surrounding work environmental heat load. ▪ Know the signs and symptoms of heat exhaustion, heat cramps, and heat stroke. Heat stroke is a true medical emergency requiring immediate emergency response action. <p>NOTE: The severity of the effects of a given environmental heat stress is decreased by reducing the work load, increasing the frequency and/or duration of rest periods, and by introducing measures which will protect employees from hot environments.</p> <ul style="list-style-type: none"> ▪ Maintain adequate water intake by drinking water periodically in small amounts throughout the day (flavoring water with citrus flavors or extracts enhances palatability). ▪ Allow approximately 2 weeks with progressive degrees of heat exposure and physical exertion for substantial acclimatization. ▪ Acclimatization is necessary regardless of an employee's physical condition (the better one's physical condition, the quicker the acclimatization). Tailor the work schedule to fit the climate, the physical condition of employees, and mission requirements. <ul style="list-style-type: none"> ▪ A reduction of work load markedly decreases total heat stress. ▪ Lessen work load and/or duration of physical exertion the first days of heat exposure to allow gradual acclimatization. ▪ Alternate work and rest periods. More severe conditions may require longer rest periods and electrolyte fluid replacement.

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 6 OF 9

Identify Hazards and PPE

Complete the checklists for hazard identification and PPE requirements. Information from the RA and applicable permits are included in this section.

Standard Hazards						
<input type="checkbox"/> Falling Objects	<input checked="" type="checkbox"/> Slips and trips	<input checked="" type="checkbox"/> Pinch points	<input type="checkbox"/> Rotating equipment			
<input type="checkbox"/> Falls	<input checked="" type="checkbox"/> Power equipment/tools	<input type="checkbox"/> Elevated work surfaces	<input type="checkbox"/> _____			
Eye Hazards						
<input checked="" type="checkbox"/> Particulates	<input type="checkbox"/> Liquid splashes	<input type="checkbox"/> Welding Arc	<input checked="" type="checkbox"/> Trees, branches, wire			
Hearing Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Impact noise	<input type="checkbox"/> High frequency noise	<input type="checkbox"/> High ambient noise			
Respiratory Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Dust/particulates	<input type="checkbox"/> Organic Vapors	<input type="checkbox"/> Acid Gases	<input type="checkbox"/> Radon	<input type="checkbox"/> Asbestos	<input type="checkbox"/> Be, Hg, Cr, Pb
<input type="checkbox"/> Oxygen deficient	<input type="checkbox"/> Welding fumes	<input type="checkbox"/> Aerosols/Particulates	<input type="checkbox"/> _____			
Chemical Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Organic solvents	<input type="checkbox"/> Reactive metals	<input type="checkbox"/> PCBs			
<input type="checkbox"/> Acids / bases	<input type="checkbox"/> Oxidizers	<input checked="" type="checkbox"/> Volatiles / Semi-volatiles	<input type="checkbox"/> _____			
Environmental Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Temperature extremes: <input checked="" type="checkbox"/> Cold <input checked="" type="checkbox"/> Heat	<input type="checkbox"/> Wet location	<input type="checkbox"/> Explosive vapors	<input type="checkbox"/> Confined space	<input type="checkbox"/> Engulfment Hazard	
<input checked="" type="checkbox"/> Bio hazards (poisonous plants, insects, animals, animal droppings, mold, fungus, etc.)			<input type="checkbox"/> _____			
Electrical Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Overhead utilities	<input type="checkbox"/> Underground utilities	<input type="checkbox"/> Hidden utilities	<input type="checkbox"/> Energized equip/circuits	<input type="checkbox"/> Wet location	
Fire Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cutting, welding, or grinding generated sparks or heat sources	<input type="checkbox"/> Flammable materials present	<input type="checkbox"/> Oxygen enriched location			
Ergonomic Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Lifting	<input type="checkbox"/> Bending	<input checked="" type="checkbox"/> Twisting	<input checked="" type="checkbox"/> Pulling/tugging	<input type="checkbox"/> Repetitive motion	
Computer Use in the:	<input type="checkbox"/> Office	<input type="checkbox"/> Field	<input checked="" type="checkbox"/> Shoveling			
Radiological Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Loose contamination	<input type="checkbox"/> Fixed Contamination	<input type="checkbox"/> Airborne contamination	<input type="checkbox"/> Radiation	<input type="checkbox"/> Radon	
<input type="checkbox"/> Alpha	<input type="checkbox"/> Beta	<input type="checkbox"/> Gamma/X-rays	<input type="checkbox"/> Neutron	<input type="checkbox"/> EMF	<input type="checkbox"/> Criticality	<input type="checkbox"/> Tritium <input type="checkbox"/> TRU
<input type="checkbox"/> Depleted Uranium	<input type="checkbox"/> Enriched Uranium	<input type="checkbox"/> _____		<input type="checkbox"/> _____		
Other Hazards						
<input type="checkbox"/>						

Completed by: _____ Date: _____

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 7 OF 9

PPE and Monitoring Requirements

Standard PPE					
<input checked="" type="checkbox"/> Hard Hat	<input checked="" type="checkbox"/> Safety shoes	<input checked="" type="checkbox"/> Safety glasses	<input type="checkbox"/> Boot Covers	<input type="checkbox"/> Rubber Boots	<input checked="" type="checkbox"/> High Visibility Vest
Eye and Face Protection					
<input type="checkbox"/> Welding glasses	<input type="checkbox"/> Welding helmet	<input type="checkbox"/> Face shield	<input type="checkbox"/> Chemical goggles	<input type="checkbox"/> Welding screens	
Hearing Protection					
<input type="checkbox"/> Ear plugs	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Ear plugs and muffs	<input type="checkbox"/> Other _____		
Respiratory Protection					
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Upgrade Only	<input type="checkbox"/> Full Face APR	<input type="checkbox"/> Half Face APR	Cart. Type _____	<input type="checkbox"/> PAPR
<input type="checkbox"/> Airline respirator	<input type="checkbox"/> SCBA	<input type="checkbox"/> Dust mask	<input type="checkbox"/> _____		
Protective Clothing					
<input type="checkbox"/> Tyvek® coveralls	<input type="checkbox"/> Poly-coated Tyvek® Coveralls	<input type="checkbox"/> Saranex® Coveralls	<input type="checkbox"/> Fully encapsulating suit	<input type="checkbox"/> Apron	
<input type="checkbox"/> Cotton coveralls	<input type="checkbox"/> Modesty Clothing	<input type="checkbox"/> Fire resistant clothing	<input type="checkbox"/> Other _____		
Hand Protection					
<input type="checkbox"/> None	<input type="checkbox"/> Cotton gloves	<input checked="" type="checkbox"/> Leather gloves	<input type="checkbox"/> Cut-resistant gloves	<input type="checkbox"/> Glove liners	
Outer Gloves					
<input type="checkbox"/> Nitrile	<input type="checkbox"/> Viton®	<input type="checkbox"/> Butyl	<input type="checkbox"/> Neoprene	<input type="checkbox"/> Other _____	
Inner Gloves					
<input type="checkbox"/> Nitrile	<input type="checkbox"/> Vinyl	<input type="checkbox"/> Latex	<input type="checkbox"/> Other _____		
Other Required PPE					
<input type="checkbox"/> Personal Flotation Device	<input type="checkbox"/> Waders _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____		
Monitoring Requirements					
<input type="checkbox"/> Oxygen	<input type="checkbox"/> Flammable gases/vapors	<input checked="" type="checkbox"/> Toxic Gas/vapors	<input type="checkbox"/> Hydrogen Sulfide	Carbon Monoxide	
<input type="checkbox"/> Asbestos	<input type="checkbox"/> Full time IH coverage	<input type="checkbox"/> Part time IH coverage	<input type="checkbox"/> Be, Hg, Cr, Pb		
<input type="checkbox"/> Metals Specify: _____					
<input checked="" type="checkbox"/> Organic Vapors Specify: _____					
<input type="checkbox"/> None	<input type="checkbox"/> TLD required	<input type="checkbox"/> CAM	<input type="checkbox"/> Radon		
<input type="checkbox"/> Full time RCT coverage	<input type="checkbox"/> Part time RCT coverage	<input type="checkbox"/> Radioactive air particulates	<input type="checkbox"/> Other _____		
<input type="checkbox"/> Other _____		<input type="checkbox"/> Other _____			

PPE and monitoring requirements completed by: _____ Date: _____

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 2 OF 3

Identify Hazards and PPE

Complete the checklists for hazard identification and PPE requirements. Information from the RA and applicable permits are included in this section.

Standard Hazards						
<input type="checkbox"/> Falling Objects	<input type="checkbox"/> Slips and trips	<input type="checkbox"/> Pinch points	<input type="checkbox"/> Rotating equipment			
<input type="checkbox"/> Falls	<input type="checkbox"/> Power equipment/tools	<input type="checkbox"/> Elevated work surfaces	<input type="checkbox"/> _____			
Eye Hazards						
<input type="checkbox"/> Particulates	<input type="checkbox"/> Liquid splashes	<input type="checkbox"/> Welding Arc	<input type="checkbox"/> _____			
Hearing Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Impact noise	<input type="checkbox"/> High frequency noise	<input type="checkbox"/> High ambient noise			
Respiratory Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Dust/particulates	<input type="checkbox"/> Organic Vapors	<input type="checkbox"/> Acid Gases	<input type="checkbox"/> Radon	<input type="checkbox"/> Asbestos	<input type="checkbox"/> Be, Hg, Cr, Pb
<input type="checkbox"/> Oxygen deficient	<input type="checkbox"/> Welding fumes	<input type="checkbox"/> Aerosols/Particulates	<input type="checkbox"/> _____			
Chemical Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Organic solvents	<input type="checkbox"/> Reactive metals	<input type="checkbox"/> PCBs			
<input type="checkbox"/> Acids / bases	<input type="checkbox"/> Oxidizers	<input type="checkbox"/> Volatiles / Semi-volatiles	<input checked="" type="checkbox"/> Insect Repellants _____			
Environmental Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Temperature extremes: <input checked="" type="checkbox"/> Cold <input checked="" type="checkbox"/> Heat	<input type="checkbox"/> Wet location	<input type="checkbox"/> Explosive vapors	<input type="checkbox"/> Confined space	<input type="checkbox"/> Engulfment Hazard	
<input checked="" type="checkbox"/> Bio hazards (poisonous plants, insects, animals, animal droppings, mold, fungus, etc.)			<input type="checkbox"/> _____			
Electrical Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Overhead utilities	<input type="checkbox"/> Underground utilities	<input type="checkbox"/> Hidden utilities	<input type="checkbox"/> Energized equip/circuits	<input type="checkbox"/> Wet location	
Fire Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cutting, welding, or grinding generated sparks or heat sources	<input type="checkbox"/> Flammable materials present	<input type="checkbox"/> Oxygen enriched location			
Ergonomic Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Lifting	<input type="checkbox"/> Bending	<input type="checkbox"/> Twisting	<input type="checkbox"/> Pulling/tugging	<input type="checkbox"/> Repetitive motion	
Computer Use in the:	<input type="checkbox"/> Office	<input type="checkbox"/> Field	<input type="checkbox"/> _____			
Radiological Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Loose contamination	<input type="checkbox"/> Fixed Contamination	<input type="checkbox"/> Airborne contamination	<input type="checkbox"/> Radiation	<input type="checkbox"/> Radon	
<input type="checkbox"/> Alpha	<input type="checkbox"/> Beta	<input type="checkbox"/> Gamma/X-rays	<input type="checkbox"/> Neutron	<input type="checkbox"/> EMF	<input type="checkbox"/> Criticality	<input type="checkbox"/> Tritium <input type="checkbox"/> TRU
<input type="checkbox"/> Depleted Uranium	<input type="checkbox"/> Enriched Uranium	<input type="checkbox"/> _____		<input type="checkbox"/> _____		
Other Hazards						
<input type="checkbox"/>						

Completed by: Douglas Saigh Date: 07/20/11

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 3 OF 3

PPE and Monitoring Requirements

Standard PPE					
<input checked="" type="checkbox"/> Hard Hat	<input checked="" type="checkbox"/> Safety shoes	<input checked="" type="checkbox"/> Safety glasses	<input checked="" type="checkbox"/> Boot Covers	<input type="checkbox"/> Rubber Boots	<input type="checkbox"/> High Visibility Vest
Eye and Face Protection					
<input type="checkbox"/> Welding glasses	<input type="checkbox"/> Welding helmet	<input type="checkbox"/> Face shield	<input type="checkbox"/> Chemical goggles	<input type="checkbox"/> Welding screens	
Hearing Protection					
<input type="checkbox"/> Ear plugs	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Ear plugs and muffs	<input type="checkbox"/> Other _____		
Respiratory Protection					
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Upgrade Only	<input type="checkbox"/> Full Face APR	<input type="checkbox"/> Half Face APR	Cart. Type _____	<input type="checkbox"/> PAPR
<input type="checkbox"/> Airline respirator	<input type="checkbox"/> SCBA	<input type="checkbox"/> Dust mask	<input type="checkbox"/> _____		
Protective Clothing					
<input type="checkbox"/> Tyvek® coveralls	<input type="checkbox"/> Poly-coated Tyvek® Coveralls	<input type="checkbox"/> Saranex® Coveralls	<input type="checkbox"/> Fully encapsulating suit	<input type="checkbox"/> Apron	
<input type="checkbox"/> Cotton coveralls	<input type="checkbox"/> Modesty Clothing	<input type="checkbox"/> Fire resistant clothing	<input type="checkbox"/> Other _____		
Hand Protection					
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cotton gloves	<input type="checkbox"/> Leather gloves	<input type="checkbox"/> Cut-resistant gloves	<input type="checkbox"/> Glove liners	
Outer Gloves					
<input type="checkbox"/> Nitrile	<input type="checkbox"/> Viton®	<input type="checkbox"/> Butyl	<input type="checkbox"/> Neoprene	<input type="checkbox"/> Other _____	
Inner Gloves					
<input type="checkbox"/> Nitrile	<input type="checkbox"/> Vinyl	<input type="checkbox"/> Latex	<input type="checkbox"/> Other _____		
Other Required PPE					
<input type="checkbox"/> Personal Flotation Device	<input type="checkbox"/> Waders _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____		
Monitoring Requirements					
<input type="checkbox"/> Oxygen	<input type="checkbox"/> Flammable gases/vapors	<input type="checkbox"/> Toxic Gas/vapors	<input type="checkbox"/> Hydrogen Sulfide	Carbon Monoxide	
<input type="checkbox"/> Asbestos	<input type="checkbox"/> Full time IH coverage	<input type="checkbox"/> Part time IH coverage	<input type="checkbox"/> Be, Hg, Cr, Pb		
<input type="checkbox"/> Metals Specify: _____					
<input type="checkbox"/> Organic Vapors Specify: _____					
<input checked="" type="checkbox"/> None	<input type="checkbox"/> TLD required	<input type="checkbox"/> CAM	<input type="checkbox"/> Radon		
<input type="checkbox"/> Full time RCT coverage	<input type="checkbox"/> Part time RCT coverage	<input type="checkbox"/> Radioactive air particulates	<input type="checkbox"/> Other _____		
<input type="checkbox"/> Other _____		<input type="checkbox"/> Other _____			

PPE and monitoring requirements completed by: Douglas Saigh Date: 07/20/11

Job Hazard Analysis - HASP Format

JHA No.: JHA - Novi - 010 - 11 - 01

Job Title: Drilling / Geoprobe Operation

Date of Analysis: 09/26/11

Job Location: Honeywell Lake Linden-C&H Power Plant Site

Minimum Recommended PPE*: High visibility vest, hard hat, steel-toed boots, safety glasses, hearing protection, gloves

Project Manager: Art Losey – Coleman Engineering Company

Project Manager: Dan Dyer - AMEC

*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Drive geoprobe onto site	1A) Malfunction of vehicle/equipment	1A) Drivers shall perform a pre-operational check of equipment, read and be familiar with any operator's manual. <ul style="list-style-type: none"> ▪ Report all needed repairs promptly. ▪ Operators shall not use defective/unsafe equipment.
	1B) Wreck of geoprobe while being driven	1B) Wreck of drill rig while being driven <ul style="list-style-type: none"> ▪ All drivers shall be properly licensed. ▪ Supervisors shall verify that drivers are capable and qualified on each type of equipment before allowing the equipment to be used unsupervised. ▪ Keep wind shields, windshield wipers, side mirrors and side windows clean ▪ Drivers shall conduct a pre-operation vehicle safety check ▪ Drivers shall plan ahead to minimize or eliminate the need for backing. Always check to the rear before backing and use an observer when available. If an observer is not available, the driver shall walk around the vehicle to make sure rear is clear prior to backing. ▪ Seat belts shall be worn when driving by driver and passengers. ▪ Choose the safest location possible to park equipment. Avoid parking in blind spots of other equipment. ▪ Driver is to be sure the back-up alarm is working ▪ Adjust vehicle speed for load and weather. Tire chains should be utilized as dictated by weather conditions. ▪ Operators should always check and be sure of load height. ▪ When operating a vehicle off the roadway, be aware of possible hidden objects in the grass and unstable terrain. ▪ The mast shall always be in a lowered position when moving the drill rig. ▪ Never allow anyone between truck and trailer when backing to hook trailer ▪ Make sure tilt beds or ramps are secured before putting trailer in use ▪ Perform periodic checks of equipment on long trips to assure the load is secure. ▪ Do not leave equipment unattended with the engine running. Shut off engine and set the parking brake when equipment is not in use.
2. Mounting and dismounting equipment	2A) Fall while mounting and dismounting equipment	2A) When mounting and dismounting equipment, use steps and handhold. Do not jump from vehicle.
3. Loading/unloading of equipment	3A) Crush and pinch points created when loading/unloading equipment	3A) Crush and pinch points created when loading/unloading equipment <ul style="list-style-type: none"> ▪ Be aware of crushing and pinching hazards when loading, unloading and fastening down equipment. ▪ Make sure cargo is properly loaded, secured and covered using only approved chain and load binders. Check for loose material on bed and trailer. Secure loose material. ▪ Wear protective equipment consistent with the hazard (hard hats, safety glasses, leather gloves, safety shoes, etc.)

Job Hazard Analysis - HASP Format

Key Work Steps	Hazards/Potential Hazards	Safe Practices
		<ul style="list-style-type: none"> ▪ Hook/unhook on stable ground with the trailer secure.
4. Geoprobe equipment operation.	4A) Crushing injuries, slip trips and falls, material under stress, power equipment operations, utility lines, overhead loads, flying particles, rope or cable blocks, equipment limitations, lifting and pinch points	4A) Rig equipment operation. <ul style="list-style-type: none"> ▪ Before use, inspect cable, chain or wire for wear and replace if necessary. ▪ Observe OSHA guidelines for use of cable clamps, safety latches, chains and slings. ▪ Know rated capacity of chain, cable or wire rope being used and never exceed the rating. ▪ Avoid overloading and sudden jerks. ▪ Wear appropriate personal protective equipment with the hazard, including hard hats, safety glasses, leather gloves and safety shoes. ▪ Check loads to be lifted for balance and have the rigging inspected to ensure a safe and balanced condition exists. ▪ Do not allow employees to stand or work under suspended loads. ▪ Awkward loads shall have taglines attached to control the load. ▪ Review signals and operator communications with crew. Only one person shall direct the operator. ▪ Review the area for utility lines, tree limbs and other overhead hazards. Work no closer than 10 feet to active overhead power lines. Follow OSHA guidelines. ▪ Personnel working tag lines shall review the area for slipping, tripping and falling hazards. If not possible to eliminate the hazards, take precautions to avoid them.
5. Stabilize rig with hydraulic jack/pads	5A) Crushing injuries, slip, trip, fall hazards and potential back injuries.	5A) Crushing injuries, slip, trip, fall hazards and potential back injuries. <ul style="list-style-type: none"> ▪ Use proper lifting techniques. ▪ Ensure jack is rated for weight/operation with safe limits ▪ Assure that area is clear of personnel and obstacles. ▪ Place pads under jacks to prevent them from sinking into the ground.
6. Start/operate geoprobe rig	6A) Moving machinery parts, buried and overhead utilities, drill rod stacking, lifting, winching, cathead operations, moving equipment, noise, adverse weather conditions, animals, slippery surfaces, uneven terrain, poisonous plants/snakes/insects and overhead hazards	6A) Moving machinery parts, buried and overhead utilities, drill rod stacking, lifting, winching, cathead operations, moving equipment, noise, adverse weather conditions, animals, slippery surfaces, uneven terrain, poisonous plants/snakes/insects and overhead hazards <ul style="list-style-type: none"> ▪ Wear appropriate personal protective equipment consistent with the hazard (hard hat, safety glasses, leather gloves, safety shoes, etc.) ▪ Avoid contact with rotating equipment ▪ When cathead is in use, assure a safe travel path for the rope by using proper techniques. Avoid standing on the rope. ▪ Observe and stay clear (minimum of 10 feet for nominal system voltage, utility lines, rated 50kV and an additional 0.4 inch for each kV over 50kV or twice the length of the line insulator, but never less than 10 feet) of overhead utility lines. <ul style="list-style-type: none"> - In transit with no load and boom lowered, the equipment clearance shall be a minimum of 4 feet for voltage less than 50kV and 10 feet for voltages over 50kV up to and including 345kV and 16 feet for voltages up to and including 750kV. - A person shall be designated to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means. - Have underground utility lines properly located and marked prior to drilling. ▪ Employees on foot must use extreme caution to stay clear of operating equipment. Always establish eye contact with the operator before approaching the equipment. ▪ Be aware of drop-offs, uneven ground and potential hidden objects which may cause loss of control when maneuvering drill rigs or create unstable drill set-ups. In heavily wooded area, scout to locate hidden objects. ▪ Drill rod stacking must not exceed a length of 1.5 times the height of

Job Hazard Analysis - HASP Format

Key Work Steps	Hazards/Potential Hazards	Safe Practices
		<p>the tower.</p> <ul style="list-style-type: none"> ▪ Be aware of poisonous plants, insects, snakes, animals and animal waste products and carcasses. Wear long sleeve shirts, gloves, and high top boots when hazards cannot be avoided. Proper first aid supplies, insect repellents shall accompany field crews. ▪ Be alert to conditions that can lead to slippery surfaces. Examples: high groundwater resulting in muddy soils brought to the surface by augers and the utilization of bentonite drilling fluid. ▪ Inspect all cables and clamps prior to winching operation. Stand clear of winching operations. ▪ Use proper lifting techniques. Get help or use lifting equipment. ▪ Suspend drilling operations during electrical storms ▪ Be aware of overhead hazards which may come in contact with the drill rig, when moving or setting up equipment. ▪ Complete a daily operations checklist to ensure that equipment is working properly. Make special note of emergency kill switches.
	6B) Contaminated soils, buried power or gas lines, landfills and containment of spills	<p>6A) Contaminated soils, buried power or gas lines, landfills and containment of spills</p> <ul style="list-style-type: none"> ▪ During drilling operations, always be aware of the possibility of encountering potentially hazardous materials, such as petroleum hydrocarbons, herbicides, pesticides, chemical manufacturing by-products or solid waste materials. ▪ In the event that any unknown or questionable materials are encountered, then the drilling operations are to be suspended immediately until further instructions are received from supervision. ▪ Do not handle any suspected contaminated materials unless trained to do so and proper protective methods are followed. ▪ During drilling operations, always be aware of the possibility of striking an unlocated or improperly located gas or power line. ▪ In the event a buried utility line is struck, drilling operations are to be suspended immediately. <ul style="list-style-type: none"> - If the utility line is electric, keep personnel at least 10 feet from all metal surfaces connected with the drill rig. - If the utility is gas, then the area is to be evacuated and secured. Immediate notification to the utility company is MANDATORY. ▪ In the event of a gas or oil spill, the proper authorities are to be contacted immediately so that containment operations can be implemented.
7. Attach auger to drill	7A) Auger coming loose from drill	<p>7A) Auger coming loose from drill Insert a holding pin in auger</p> <ul style="list-style-type: none"> ▪ Insert a holding pin in auger ▪ Use personal protective equipment such as leather gloves, safety glasses, hard hat and safety shoes. ▪ Be aware of hand and finger positions when inserting holding pin
8. Start geoprobe by lever operations	8A) Operation of wrong lever	8A) Label levers as to their operation and review equipment manual.
9. Maintain proper geoprobe speed with down hole pressure speed.	9A) Unstable rig from improper speed probe	9A) Use of trained geoprobe personnel and follow equipment manual specification.
10. Collect core samples	10A) Cuts	10A) Use proper cutting tool to open sample core. Use proper sample handling techniques and preservatives.
11. Install hole plug (50 pound bags of bentonite) into hole (by pouring) to ground surface.	12A) Back injuries, slips and falls	12A) Proper lifting procedures, team lifting and use of mechanical devices. Wear proper foot wear and maintain area in good housekeeping condition.
12. Reverse auger after each five foot section of sand is installed	13A) Reference hazard item #4	14A) Reference Control item #4

Job Hazard Analysis - HASP Format

Key Work Steps	Hazards/Potential Hazards	Safe Practices
13. Decontamination of drill equipment- usually pressure water	18A) Contamination of personnel and environment	18A) Follow health and safety plan, dress to proper EPA level, contain material washed from contaminated equipment with proper containment materials. Trained/authorized personnel to use pressure washer and assure area is clean of personnel prior to operation of pressure water device.
14. Driving drilling rig offsite.	22A) Reference item # 1	22A) Reference item #1.

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Job Hazard Analysis Form

JHA No.: JHA - NOVI - 011 - 11 - 01

Job Title: Surveying **Date of Analysis:** 09/26/11

Job Location: Lake Linden-Calumet & Helca Power Plant Site **Project Manager:** Dan Dyer – AMEC
Project Manager: Jim Moore - CEC

Applicable ES&H Procedures:

- 2.9.A - Hazardous Waste Operations and Emergency Response Program
- 2.9.B - Hearing Conservation Program
- 2.9.C - Respiratory Protection Program
- 2.9.D - Personal Protective Equipment Program
- 2.9.E - Hazard Communication Program
- 2.9.F - Bloodborne Pathogens Program
- 2.5.1 - Operation of Company Vehicles and Use of Personal Vehicles on Company Business
- 2.5.2 - Heavy Equipment
- 2.9.7 - Overhead and Underground Utilities
- 2.9.9 - Excavation and Trenching
- 2.9.11 - Exposure Monitoring
- 2.9.16 - Thermal Stress
- 2.9.19 - Electrical Safety
- 2.13.1 - Medical Surveillance
- 2.13.2 - Medical Emergencies and First Aid
- 2.14.1 - Flammable and Combustible Liquids
- 2.14.2 - Handling, Storage, and Control of Hazardous Chemicals

Other Referenced JHAs:

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Going to site, work preparation	1A) Mobilization / Demobilization and Site Preparation	1A) See HASP for Mobilization Demobilization and Site Preparation
2. Working at the site	2A) General Field Work – Walking and working in the field, Environmental conditions, communication	2A) See HASP for General Field Work
3. Setting up survey location(s)	8A) Exposure to traffic	4A) Exposure to traffic <ul style="list-style-type: none"> ▪ Use cones if working within 15 feet of road ▪ Wear high visibility vest
	4B) Property access <ul style="list-style-type: none"> ▪ Animal bites ▪ Electrocutation 	1A) Ensure communications with the property owner. Request pets and animals to be confined during the survey. <ul style="list-style-type: none"> ▪ Maintain communications via two way radios or cell phones. ▪ Learn animal posturing including how to identify rabid animals. ▪ Be prepared with a site map as necessary. ▪ Be aware of overhead and underground utilities. Ensure Miss Dig has cleared the area if conducting invasive studies. When working with electrical equipment avoid wet surfaces and exposed connections.
	4C) Exposure to biting or stinging insects	1B) See HASP – Insect Bites and Stings
	4D) Contact with poisonous or irritant plants:	1C) Contact with poisonous plants or the oil from those plants: <ul style="list-style-type: none"> ▪ Look for signs of poisonous plants and avoid. ▪ Wear PPE as described in the HASP. ▪ Discard PPE in accordance with the HASP.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	4E) Slips, Trips and Falls	1D) Slips, Trips and Falls <ul style="list-style-type: none"> ▪ Wear appropriate foot protection. Ensure proper footing. Be aware of uneven and slippery surfaces. Use care when climbing over and through brush, stumps, rocks, and logs.
	4F) Exposure to hazardous Inhalation and contact with hazardous substances (VOC contaminated groundwater/soil); liquid splash; flammable atmospheres, dust.	1E) Exposure to hazardous substances <ul style="list-style-type: none"> ▪ Wear PPE as identified in HASP. ▪ Review hazardous properties of site contaminants with workers before surveying operations begin ▪ Monitor breathing zone air in accordance with HASP to determine levels of contaminants present. ▪ When decontaminating equipment wear additional eye/face protection over the safety glasses such as a face shield.
4. Removing instruments/equipment from vehicle/case and place it on tripod	5A) Back strain due to lifting, pulling or tugging equipment	5A) Back strain <ul style="list-style-type: none"> ▪ Use mechanical aids when possible, if mechanical aids are not available, use two person lifts for heavy items. ▪ Use proper lifting techniques
	5B) Foot injuries from dropped equipment	5B) Foot Injuries <ul style="list-style-type: none"> ▪ Be aware when moving objects, ensure you have a good grip when lifting and carrying objects. ▪ Do not carry more than you can handle safely ▪ Wear steel toed boots
5. Moving to new survey locations	6A) Back strain due to lifting equipment or moving equipment to from location to location.	6A) Back strain <ul style="list-style-type: none"> ▪ Use mechanical aids when possible, if mechanical aids are not available, use two person lifts for heavy items. ▪ Use proper lifting techniques

Identify Hazards and PPE

Complete the checklists for hazard identification and PPE requirements.

Standard Hazards							
<input type="checkbox"/> Falling Objects	<input checked="" type="checkbox"/> Slips and trips	<input type="checkbox"/> Pinch points	<input type="checkbox"/> Rotating equipment				
<input type="checkbox"/> Falls	<input type="checkbox"/> Power equipment/tools	<input type="checkbox"/> Elevated work surfaces	<input type="checkbox"/> _____				
Eye Hazards							
<input type="checkbox"/> Particulates	<input type="checkbox"/> Liquid splashes	<input type="checkbox"/> Welding Arc	<input type="checkbox"/> _____				
Hearing Hazards							
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Impact noise	<input type="checkbox"/> High frequency noise	<input type="checkbox"/> High ambient noise				
Respiratory Hazards							
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Dust/particulates	<input checked="" type="checkbox"/> Organic Vapors	<input type="checkbox"/> Acid Gases	<input type="checkbox"/> Radon	<input checked="" type="checkbox"/> Asbestos	<input checked="" type="checkbox"/> Be, Hg, Cr, Pb	
<input type="checkbox"/> Oxygen deficient	<input type="checkbox"/> Welding fumes	<input type="checkbox"/> Aerosols/Particulates		<input type="checkbox"/> _____			
Chemical Hazards							
<input type="checkbox"/> None	<input type="checkbox"/> Organic solvents	<input type="checkbox"/> Reactive metals	<input checked="" type="checkbox"/> PCBs				
<input type="checkbox"/> Acids / bases	<input type="checkbox"/> Oxidizers	<input checked="" type="checkbox"/> Volatiles / Semi-volatiles		<input type="checkbox"/> _____			
Environmental Hazards							
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Temperature extremes: <input type="checkbox"/> Cold <input type="checkbox"/> Heat	<input type="checkbox"/> Wet location	<input type="checkbox"/> Explosive vapors	<input type="checkbox"/> Confined space	<input type="checkbox"/> Engulfment Hazard		
<input checked="" type="checkbox"/> Bio hazards (poisonous plants, insects, animals, animal droppings, mold, fungus, etc.)				<input type="checkbox"/> _____			
Electrical Hazards							
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Overhead utilities	<input type="checkbox"/> Underground utilities	<input type="checkbox"/> Hidden utilities	<input type="checkbox"/> Energized equip/circuits	<input type="checkbox"/> Wet location		
Fire Hazards							
<input type="checkbox"/> None	<input type="checkbox"/> Cutting, welding, or grinding generated sparks or heat sources		<input type="checkbox"/> Flammable materials present		<input type="checkbox"/> Oxygen enriched location		
Ergonomic Hazards							
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Lifting	<input checked="" type="checkbox"/> Bending	<input checked="" type="checkbox"/> Twisting	<input type="checkbox"/> Pulling/tugging	<input type="checkbox"/> Repetitive motion		
Computer Use in the:	<input type="checkbox"/> Office	<input type="checkbox"/> Field	<input type="checkbox"/> _____				
Radiological Hazards							
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Loose contamination	<input type="checkbox"/> Fixed Contamination	<input type="checkbox"/> Airborne contamination	<input type="checkbox"/> Radiation	<input type="checkbox"/> Radon		
<input type="checkbox"/> Alpha	<input type="checkbox"/> Beta	<input type="checkbox"/> Gamma/X-rays	<input type="checkbox"/> Neutron	<input type="checkbox"/> EMF	<input type="checkbox"/> Criticality	<input type="checkbox"/> Tritium	<input type="checkbox"/> TRU
<input type="checkbox"/> Depleted Uranium		<input type="checkbox"/> Enriched Uranium		<input type="checkbox"/> _____		<input type="checkbox"/> _____	
Other Hazards							
<input type="checkbox"/>							

Completed by: Dave Schmutzler

Date: 09/26/11

PPE and Monitoring Requirements

Standard PPE					
<input checked="" type="checkbox"/> Hard Hat	<input checked="" type="checkbox"/> Safety shoes	<input checked="" type="checkbox"/> Safety glasses	<input type="checkbox"/> Boot Covers	<input type="checkbox"/> Rubber Boots	<input type="checkbox"/> High Visibility Vest
Eye and Face Protection					
<input type="checkbox"/> Welding glasses	<input type="checkbox"/> Welding helmet	<input type="checkbox"/> Face shield	<input type="checkbox"/> Chemical goggles	<input type="checkbox"/> Welding screens	
Hearing Protection					
<input type="checkbox"/> Ear plugs	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Ear plugs and muffs	<input type="checkbox"/> Other _____		
Respiratory Protection					
<input type="checkbox"/> None	<input type="checkbox"/> Upgrade Only	<input type="checkbox"/> Full Face APR	<input type="checkbox"/> Half Face APR	Cart. Type _____	<input type="checkbox"/> PAPR
<input type="checkbox"/> Airline respirator	<input type="checkbox"/> SCBA	<input type="checkbox"/> Dust mask	<input type="checkbox"/> _____		
Protective Clothing					
<input type="checkbox"/> Tyvek® coveralls	<input type="checkbox"/> Poly-coated Tyvek® Coveralls	<input type="checkbox"/> Saranex® Coveralls	<input type="checkbox"/> Fully encapsulating suit	<input type="checkbox"/> Apron	
<input type="checkbox"/> Cotton coveralls	<input type="checkbox"/> Modesty Clothing	<input type="checkbox"/> Fire resistant clothing	<input type="checkbox"/> Other _____		
Hand Protection					
<input type="checkbox"/> None	<input type="checkbox"/> Cotton gloves	<input type="checkbox"/> Leather gloves	<input type="checkbox"/> Cut-resistant gloves	<input type="checkbox"/> Glove liners	
Outer Gloves					
<input checked="" type="checkbox"/> Nitrile	<input type="checkbox"/> Viton®	<input type="checkbox"/> Butyl	<input type="checkbox"/> Neoprene	<input type="checkbox"/> Other _____	
Inner Gloves					
<input type="checkbox"/> Nitrile	<input type="checkbox"/> Vinyl	<input type="checkbox"/> Latex	<input type="checkbox"/> Other _____		
Other Required PPE					
<input type="checkbox"/> Personal Flotation Device	<input type="checkbox"/> Waders _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____		
Monitoring Requirements					
<input type="checkbox"/> Oxygen	<input type="checkbox"/> Flammable gases/vapors	<input type="checkbox"/> Toxic Gas/vapors	<input type="checkbox"/> Hydrogen Sulfide	Carbon Monoxide	
<input type="checkbox"/> Asbestos	<input type="checkbox"/> Full time IH coverage	<input type="checkbox"/> Part time IH coverage	<input type="checkbox"/> Be, Hg, Cr, Pb		
<input type="checkbox"/> Metals Specify: _____					
<input checked="" type="checkbox"/> Organic Vapors Specify: <u>VOCs (only for well casing surveys)</u>					
<input type="checkbox"/> None	<input type="checkbox"/> TLD required	<input type="checkbox"/> CAM	<input type="checkbox"/> Radon		
<input type="checkbox"/> Full time RCT coverage	<input type="checkbox"/> Part time RCT coverage	<input type="checkbox"/> Radioactive particulates	air	<input type="checkbox"/> Other _____	
<input type="checkbox"/> Other _____		<input type="checkbox"/> Other _____			

PPE and monitoring requirements completed by: Dave SchmutzlerDate: 09/26/11

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 1 OF 5

Job Hazard Analysis Form

JHA No.: JHA - NOVI - 012 - 11 - 01

Job Title: Industrial Hygiene Sampling **Date of Analysis:** 7/1/07

Job Location: _____ **Team Leader/Project Manager:** _____

- Applicable ES&H Procedures:**
- 2.9.A - Hazardous Waste Operations and Emergency Response Program
 - 2.9.C - Respiratory Protection Program
 - 2.9.D - Personal Protective Equipment Program
 - 2.9.E - Hazard Communication Program
 - 2.5.1 - Operation of Company Vehicles and Use of Personal Vehicles on Company Business
 - 2.9.11 - Exposure Monitoring
 - 2.13.1 - Medical Surveillance
 - 2.13.2 - Medical Emergencies and First Aid
 - 2.14.1 - Flammable and Combustible Liquids
 - 2.14.2 - Handling, Storage, and Control of Hazardous Chemicals
 - 2.14.3 - Spill Containment

- Other Referenced JHAs:**
- Vehicle - Travel
 - Mobilization/Demobilization and Site Preparation JHA
 - Field Work - General
 - Poisonous Plants
 - Insect Stings and Bites

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Work preparation	1A) N/A	1A) Work Preparation <ul style="list-style-type: none"> ▪ Charge pumps ▪ Determine PPE requirements for site ▪ Review HASP ▪ Receive site specific training, if required. ▪ Calibrate pumps
2. Traveling to the jobsite	2A) See JHA Vehicle - Travel	2A) See JHA Vehicle - Travel
	2B) If sampling at hazardous waste site	2B) If sampling at hazardous waste site <ul style="list-style-type: none"> ▪ See JHA - Mobilization/Demobilization and Site Preparation ▪ See JHA – Field Work - General
3. Lifting and carrying various items	3A) Strains (overexertion)	3A) Strains (overexertion) <ul style="list-style-type: none"> ▪ Determine whether item is too heavy or bulky for one person to carry; get help ▪ Make two trips if necessary, ▪ Use proper lifting techniques
	3B) Falls	3B) Falls <ul style="list-style-type: none"> ▪ Always be able to see where you are going and what might be an obstacle in your path ▪ If sampling inside of a multi story building, use the elevator, if available, rather than stairs when carrying something that takes both hands

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2

Owner: H.J. Gordon Approver: S. D. Rima PAGE 2 OF 5

Key Work Steps	Hazards/Potential Hazards	Safe Practices
4. Accessing Monitoring Sites in the Field	4A) Exposure to lightning, snakes, spiders, poison ivy, ticks, mosquitoes	4A) Exposure to lightning, snakes, spiders, poison ivy, ticks, mosquitoes <ul style="list-style-type: none"> ▪ See JHA – Poisonous Plants ▪ See JHA – Insect Stings and Bites ▪ Wear pants and, if needed, long sleeves ▪ Stay indoors during lightning storms ▪ Know location of nearest hospital ▪ Keep lawn around monitoring sites mowed ▪ Be mindful of where you step
5. Place pumps and sampling media on workers	5A) Tubing is loose and becomes caught on or in objects or equipment	5A) Tubing is loose and becomes caught on or in equipment <ul style="list-style-type: none"> ▪ Hook pump to back waistband of pants. Pump should be positioned over the right or left hip. ▪ Position tubing so it crosses over back and over opposite shoulder (shoulder opposite to hip where pump has been placed). ▪ Connect filter or charcoal tube to collar, near mouth and nose (breathing zone using alligator clip. ▪ Use duct tape or clips to secure tubing so as allow free movement, but not so loose as to catch on objects or equipment
	5B) Cuts (glass sample tube)	5B) Ends of glass sample media exposed <ol style="list-style-type: none"> a) Use rubber shield to protect worker from sharp edges b) Use tube breaker tool (catches the broken glass) c) Dispose of glass in sharps container d) Wear safety glasses to break tubes e) Replace plastic caps on glass tube ends upon completion of sampling for shipping. f) Do not use excessive force to slide caps on the tube ends. (potential slip and cut.)
6. Place pumps in work zone for area samples	6A) Slips, trips, falls	6A) Slips, trips, falls <ul style="list-style-type: none"> ▪ Wear proper footwear for site conditions ▪ Watch placement of feet ▪ Do not use furniture as stepladders to reach high places, use a step stool or step ladder. ▪ Position area pumps and pump stands out of walking area and from blocking doorways, if possible. Use warning barriers and tape for awareness.
	6B) Strain (overexertion)	6B) Strain (overexertion) <ul style="list-style-type: none"> ▪ Take care when carrying equipment (pumps, tripod or other item to be used to position pump at breathing zone level) ▪ Get help or make two trips if required.
7. Start pumps and record time. Periodically monitor pumps to ensure operating correctly.	7A) Slips, trips, falls	7A) Slips, trips, falls <ul style="list-style-type: none"> ▪ Wear proper footwear for site conditions ▪ Watch placement of feet ▪ Do not use furniture as stepladders to reach high places, use a stepstool or stepladder.
8. Using various chemicals, such as charcoal, dessicant, etc.	8A) Contact with materials that causes irritation, allergic response, or skin problems	8A) Contact with materials that causes irritation, allergic response, or skin problems <ul style="list-style-type: none"> ▪ Read and follow all instructions regarding proper use ▪ If allergic reaction or irritation occurs, report to supervisor so chemical can be replaced with safer material ▪ Keep MSDS sheets on hand ▪ Wear proper eyewear, masks, and gloves when using certain chemicals

CORPORATE ES&H PROCEDURE

Issued: **1/23/06** Effective: **1/24/06** **ESH-2.9.1 REVISION 2**

Owner: **H.J. Gordon** Approver: **S. D. Rima** **PAGE 3 OF 5**

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	8B) Spills	8B) Spills <ul style="list-style-type: none">▪ Have clean-up plan for spills▪ Keep water on hand for rinsing off skin

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 4 OF 5

Identify Hazards and PPE

Complete the checklists for hazard identification and PPE requirements. Information from the RA and applicable permits are included in this section.

Standard Hazards						
<input type="checkbox"/> Falling Objects	<input checked="" type="checkbox"/> Slips and trips	<input type="checkbox"/> Pinch points	<input type="checkbox"/> Rotating equipment			
<input checked="" type="checkbox"/> Falls	<input type="checkbox"/> Power equipment/tools	<input type="checkbox"/> Elevated work surfaces	<input type="checkbox"/> _____			
Eye Hazards						
<input type="checkbox"/> Particulates	<input type="checkbox"/> Liquid splashes	<input type="checkbox"/> Welding Arc	<input type="checkbox"/> _____			
Hearing Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Impact noise	<input type="checkbox"/> High frequency noise	<input type="checkbox"/> High ambient noise			
Respiratory Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Dust/particulates	<input type="checkbox"/> Organic Vapors	<input type="checkbox"/> Acid Gases	<input type="checkbox"/> Radon	<input type="checkbox"/> Asbestos	<input type="checkbox"/> Be, Hg, Cr, Pb
<input type="checkbox"/> Oxygen deficient	<input type="checkbox"/> Welding fumes	<input type="checkbox"/> Aerosols/Particulates	<input type="checkbox"/> _____			
Chemical Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Organic solvents	<input type="checkbox"/> Reactive metals	<input type="checkbox"/> PCBs			
<input type="checkbox"/> Acids / bases	<input type="checkbox"/> Oxidizers	<input type="checkbox"/> Volatiles / Semi-volatiles	<input type="checkbox"/> _____			
Environmental Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Temperature extremes: <input type="checkbox"/> Cold <input type="checkbox"/> Heat	<input type="checkbox"/> Wet location	<input type="checkbox"/> Explosive vapors	<input type="checkbox"/> Confined space	<input type="checkbox"/> Engulfment Hazard	
<input type="checkbox"/> Bio hazards (poisonous plants, insects, animals, animal droppings, mold, fungus, etc.)			<input type="checkbox"/> _____			
Electrical Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Overhead utilities	<input type="checkbox"/> Underground utilities	<input type="checkbox"/> Hidden utilities	<input type="checkbox"/> Energized equip/circuits	<input type="checkbox"/> Wet location	
Fire Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cutting, welding, or grinding generated sparks or heat sources	<input type="checkbox"/> Flammable materials present	<input type="checkbox"/> Oxygen enriched location			
Ergonomic Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Lifting	<input type="checkbox"/> Bending	<input type="checkbox"/> Twisting	<input type="checkbox"/> Pulling/tugging	<input type="checkbox"/> Repetitive motion	
Computer Use in the:	<input type="checkbox"/> Office	<input type="checkbox"/> Field	<input type="checkbox"/> _____			
Radiological Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Loose contamination	<input type="checkbox"/> Fixed Contamination	<input type="checkbox"/> Airborne contamination	<input type="checkbox"/> Radiation	<input type="checkbox"/> Radon	
<input type="checkbox"/> Alpha	<input type="checkbox"/> Beta	<input type="checkbox"/> Gamma/X-rays	<input type="checkbox"/> Neutron	<input type="checkbox"/> EMF	<input type="checkbox"/> Criticality	<input type="checkbox"/> Tritium <input type="checkbox"/> TRU
<input type="checkbox"/> Depleted Uranium	<input type="checkbox"/> Enriched Uranium	<input type="checkbox"/> _____		<input type="checkbox"/> _____		
Other Hazards						
<input checked="" type="checkbox"/> Cuts						

Completed by: Cindy Sundquist Date: 7-10-2007

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 5 OF 5

PPE and Monitoring Requirements

Standard PPE					
<input type="checkbox"/> Hard Hat	<input checked="" type="checkbox"/> Safety shoes	<input checked="" type="checkbox"/> Safety glasses	<input type="checkbox"/> Boot Covers	<input type="checkbox"/> Rubber Boots	<input type="checkbox"/> High Visibility Vest
Eye and Face Protection					
<input type="checkbox"/> Welding glasses	<input type="checkbox"/> Welding helmet	<input type="checkbox"/> Face shield	<input type="checkbox"/> Chemical goggles	<input type="checkbox"/> Welding screens	
Hearing Protection					
<input type="checkbox"/> Ear plugs	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Ear plugs and muffs	<input type="checkbox"/> Other _____		
Respiratory Protection					
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Upgrade Only	<input type="checkbox"/> Full Face APR	<input type="checkbox"/> Half Face APR	Cart. Type _____	<input type="checkbox"/> PAPR
<input type="checkbox"/> Airline respirator	<input type="checkbox"/> SCBA	<input type="checkbox"/> Dust mask	<input type="checkbox"/> _____		
Protective Clothing					
<input type="checkbox"/> Tyvek® coveralls	<input type="checkbox"/> Poly-coated Tyvek® Coveralls	<input type="checkbox"/> Saranex® Coveralls	<input type="checkbox"/> Fully encapsulating suit	<input type="checkbox"/> Apron	
<input type="checkbox"/> Cotton coveralls	<input type="checkbox"/> Modesty Clothing	<input type="checkbox"/> Fire resistant clothing	<input type="checkbox"/> Other _____		
Hand Protection					
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cotton gloves	<input type="checkbox"/> Leather gloves	<input type="checkbox"/> Cut-resistant gloves	<input type="checkbox"/> Glove liners	
Outer Gloves					
<input type="checkbox"/> Nitrile	<input type="checkbox"/> Viton®	<input type="checkbox"/> Butyl	<input type="checkbox"/> Neoprene	<input type="checkbox"/> Other _____	
Inner Gloves					
<input type="checkbox"/> Nitrile	<input type="checkbox"/> Vinyl	<input type="checkbox"/> Latex	<input type="checkbox"/> Other _____		
Other Required PPE					
<input type="checkbox"/> Personal Flotation Device	<input type="checkbox"/> Waders _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____		
Monitoring Requirements					
<input type="checkbox"/> Oxygen	<input type="checkbox"/> Flammable gases/vapors	<input type="checkbox"/> Toxic Gas/vapors	<input type="checkbox"/> Hydrogen Sulfide	Carbon Monoxide	
<input type="checkbox"/> Asbestos	<input type="checkbox"/> Full time IH coverage	<input type="checkbox"/> Part time IH coverage	<input type="checkbox"/> Be, Hg, Cr, Pb		
<input type="checkbox"/> Metals Specify: _____					
<input type="checkbox"/> Organic Vapors Specify: _____					
<input type="checkbox"/> None	<input type="checkbox"/> TLD required	<input type="checkbox"/> CAM	<input type="checkbox"/> Radon		
<input type="checkbox"/> Full time RCT coverage	<input type="checkbox"/> Part time RCT coverage	<input type="checkbox"/> Radioactive air particulates	<input type="checkbox"/> Other _____		
<input type="checkbox"/> Other _____		<input type="checkbox"/> Other _____			

PPE and monitoring requirements completed by: Cindy Sundquist Date: 7-10-2007

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 1 OF 6

Job Hazard Analysis Form

JHA No.: JHA - Novi - 013 - 11 - 01

Job Title: Chain Saws

Date of Analysis: 9/27/11

Job Location: Honeywell Lake Linden-C&H Power Plant Site

Project Manager: Dan Dyer

- Applicable ES&H Procedures:**
- 2.9.A - Hazardous Waste Operations and Emergency Response Program
 - 2.9.B - Hearing Conservation Program
 - 2.9.C - Respiratory Protection Program
 - 2.9.D - Personal Protective Equipment Program
 - 2.9.E - Hazard Communication Program
 - 2.5.1 - Operation of Company Vehicles and Use of Personal Vehicles on Company Business
 - 2.9.16 - Thermal Stress
 - 2.9.21 - Power and Hand Tools
 - 2.13.1 - Medical Surveillance
 - 2.13.2 - Medical Emergencies and First Aid
 - 2.14.1 - Flammable and Combustible Liquids

Other Referenced JHAs: Mobilization/Demobilization and Site Preparation
 Biting and Stinging Insects

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Going to site, work preparation	1A) General	1A) General <ul style="list-style-type: none"> ▪ See Mobilization/demobilization and Site Preparation JHA ▪ All operators shall receive First aid and CPR training. ▪ First aid kits shall be available at the work site and on each transport vehicle. ▪ Train new operators in chain saw use. <ul style="list-style-type: none"> ▪ Never let trainee sawyers operate without constant, direct supervision until they demonstrated the ability to handle the saw independently and proficiently. ▪ Ensure that personnel are in good physical condition before allowing them to operate a chain saw. ▪ A sawyer should not work alone. ▪ Daily safety tailgate sessions shall be conducted and documented.
	1B) Chemical Exposures	1B) Chemical Exposures <ul style="list-style-type: none"> ▪ If clearing is to be conducted at a hazardous waste site, see HASP for monitoring procedures and required PPE.
2. Personal Protective Equipment	2A) Cuts, Hearing Loss, Eye Injuries, Head injuries	2A) Cuts, Hearing Loss, Eye Injuries, Head injuries <ul style="list-style-type: none"> ▪ Wear gloves, chaps, hard hat, safety glasses, hearing protection, and sturdy boots with slip resistant soles. ▪ Use shoulder pads. ▪ Keep shirt collar up while carrying saw on shoulder. ▪ Leg protection (chaps) shall cover the full length of the thigh to the top of the boots.

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2

Owner: H.J. Gordon Approver: S. D. Rima PAGE 2 OF 6

Key Work Steps	Hazards/Potential Hazards	Safe Practices
3. Unloading equipment	3A) Pinching fingers, mashing toes, back strain	3A) Pinching fingers, mashing toes, back strain <ul style="list-style-type: none"> ▪ Use caution and be aware of hand placement ▪ Use proper lifting techniques (i.e. lift with legs not back, get assistance as necessary). ▪ Wear gloves, steel-toed shoes.
4. Carrying chain saw.	4A) Cuts, Falls, Burns	4A) Cuts, Falls, Burns <ul style="list-style-type: none"> ▪ Stop saw before carrying. ▪ Point bar forward when going downhill and the saw is at the side. ▪ Point bar to the rear when going uphill and the saw at the side. ▪ Pack and guard bar and dogs when carrying saw on the shoulder. ▪ Maintain minimum 10 feet walking space between crewmembers. ▪ Ensure fuel cap on saw is secure.
5. Starting chainsaw	5A) Cuts, eye injury, hearing damage Kickback	5A) Cuts, eye injury, hearing damage Kickback <ul style="list-style-type: none"> ▪ Wear gloves, eye and hearing protection, steel-toed shoes. Follow procedures in owner manual. ▪ There are two recognized methods for safely starting a saw. In both methods, the trigger lock should not be used. <ul style="list-style-type: none"> ▪ On Ground starting. ▪ Stand starting. ▪ Drop Starting is prohibited.
6. Cutting with chainsaw	6A) Cuts, eye injury, hearing damage, back strain, falling debris	6A) Cuts, eye injury, hearing damage, back strain, falling debris <ul style="list-style-type: none"> ▪ Wear gloves, eye and hearing protection, steel-toed shoes, back support, hard hat. ▪ Be aware of surroundings (i.e. power lines, vehicles, other employees). ▪ Use line or wedge to guide fall.
7. Reloading equipment	7A) Pinching fingers, mashing toes, back strain	7A) Pinching fingers, mashing toes, back strain <ul style="list-style-type: none"> ▪ Use caution ▪ Be aware of hand placement ▪ Use proper lifting techniques (i.e. lift with legs not back, get assistance as necessary). ▪ Wear gloves, steel-toed shoes, and back support.
8. Tree Falling	8A) Area - Size up Surrounding	8A) Area Size up Surrounding <ul style="list-style-type: none"> ▪ Determine natural lean and condition of tree (rot, splits, loose bark etc.) and the best direction to be felled. ▪ Be aware of other trees leaning into the tree being felled. ▪ Be aware of snags in the area. ▪ Do not cut during shifting, high or gusty wind conditions. ▪ Clean materials away from the tree's base that may pose a hazard. ▪ Avoid cutting above your shoulders. ▪ Before cutting determine your primary and secondary escape routes to a predetermined safe area. ▪ Using the saw, prepare your escape route by cutting all tripping hazards. ▪ Keep proper spacing between operators (at least two tree lengths).

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2

Owner: H.J. Gordon Approver: S. D. Rima PAGE 3 OF 6

Key Work Steps	Hazards/Potential Hazards	Safe Practices
9. Making undercuts; Falling Materials	9A) Saw Cuts and Flying Material	<p>9A) Saw Cuts and Flying Material</p> <ul style="list-style-type: none"> ▪ The cut depth must be a minimum of 1/3 the tree's diameter. ▪ The cut width must be a minimum of 1/5 of the diameter and at 45-degree angle. ▪ Leave no Dutchman.
10. Back cut Wedging and Falling Material	10A) Announce Felling	<p>10A) Announce Felling</p> <ul style="list-style-type: none"> ▪ Notify others in the area that the tree is about to fall. ▪ Make the back cut slightly above (approximately 2 inches under cut), must be level and even. ▪ Remove loose bark before beginning back cut. ▪ Utilize swamper lookout under adverse conditions. ▪ Wedge tree as soon as possible after beginning back-cut continue with the back-cut and tamp in wedges periodical.
11. Being hit by Falling Trees and Pieces	11A) Watch-outs	<p>11A) Watch-outs</p> <ul style="list-style-type: none"> ▪ When the tree begins to fall, withdraw the saw from cut and shut off. ▪ Retreat to your safety area at an angle, not straight back. ▪ Do not turn your back on a falling tree. ▪ Continue to watch for falling limbs and/or other trees after the tree hits the ground. ▪ Try to avoid hanging tree up in standing timber. ▪ Do not attempt to fall trees without all the essential equipment. This equipment includes: PPE, chainsaw, small axe and swamper.
12. Limbing	12A) Kickback, Puller/swamper, uneven terrain, Fatigue	<p>12A) Kickback, Puller/swamper, uneven terrain, Fatigue</p> <ul style="list-style-type: none"> ▪ Secure firm footing. <ul style="list-style-type: none"> ▪ Keep feet spread apart in a wide balanced stance. ▪ Feet should be placed so as to keep feet and legs away from saw chain. ▪ Keep a firm grip on saw with both hands. ▪ Look up for widow makers and other loose debris. <ul style="list-style-type: none"> ▪ Don't cut under a hazard. ▪ Remove the hazard or relocate the cutting location. ▪ Flush cut limbs and stems. ▪ Never cut with engine higher than your chest. ▪ Clear debris from cutting location so that the guide bar tip is not accidentally stubbed.
13. Saw Maintenance and Fueling	14A) Explosion, fire, hazardous vapors, splashing fuel in eyes, spills	<p>13A) Explosion, fire, hazardous vapors, splashing fuel in eyes, spills</p> <ul style="list-style-type: none"> ▪ Wear eye protection ▪ Shut off engine and let cool before refueling ▪ Refuel in well ventilated area on bare ground or other non-combustible surface ▪ Wipe fuel off saw ▪ Keep fuel away from sparks or open flame, never start saw within 10 feet of fueling area. No smoking during fueling. ▪ Do not start the saw at the point of fueling. ▪ Transport fuel in approved containers ▪ Have spill kit ready in case of fuel spill. ▪ Use proper saw gas and oil fuel mixture. Never use motor oil or bar lubricant to mix with saw gas. ▪ Fix pinched bar guide rails, bent bars or damaged tips immediately. ▪ Keep chain sharp and with proper tension at all times.

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2

Owner: H.J. Gordon Approver: S. D. Rima PAGE 4 OF 6

Key Work Steps	Hazards/Potential Hazards	Safe Practices
		<ul style="list-style-type: none"> ▪ Use gloves whenever working with the chain. ▪ Beware of hot muffler. ▪ Ensure chain brake is working properly. ▪ Ensure the carburetor is adjusted properly so the chain doesn't run at an idle. ▪ Stop saw If the bar oil runs out before the saw gas does.
14. Extra Equipment	14A) Tools	14A) Tools <ul style="list-style-type: none"> ▪ Keep axes sharp and handles tight and non-cracked. ▪ "Never" use wooden or metal wedges. ▪ Keep burs filed or cut down on plastic wedges. ▪ Utilize bar covers when saws are transported and stored.
15. Bucking Felled Trees and Kickback	15A) Bucking	15A) Bucking <ul style="list-style-type: none"> ▪ When bucking logs, be aware of the direction the logs may roll or move after bucking. ▪ Do not stand on the downhill side of logs.
16. Environmental Conditions	16A) Lightning, Rain, Strong winds, Darkness	16A) Lightning, Rain, Strong winds, Darkness <ul style="list-style-type: none"> ▪ All work shall terminate and each employee shall move to a place of safety when environmental conditions create a hazard for the employee.
17. Bee and Insects	17A) Sting Kits	17A) See JHA for Biting and Stinging Insects
18. Fatigue and Heat Stress	18A) Body Stress	18A) Body Stress <ul style="list-style-type: none"> ▪ Fatigue is a major hazard. <ul style="list-style-type: none"> ▪ Do not operate chain saw when fatigue makes proper stance and handling difficult. ▪ Set the pace, take frequent short breaks if necessary and carry and drink plenty of water. ▪ Pay attention to your physical condition. ▪ Stay alerts at all times and watch your step.
19. Fire Hazard	19A) Fire Watch	19A) Fire Watch <ul style="list-style-type: none"> ▪ After sawing, stay in the area for 10 to 15 minutes to watch for fires. ▪ All timber fallers shall carry at least an 8-ounce fire extinguisher during the fire precaution period.

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 5 OF 6

Identify Hazards and PPE

Complete the checklists for hazard identification and PPE requirements. Information from the RA and applicable permits are included in this section.

Standard Hazards						
<input checked="" type="checkbox"/> Falling Objects	<input checked="" type="checkbox"/> Slips and trips	<input checked="" type="checkbox"/> Pinch points	<input checked="" type="checkbox"/> Rotating equipment			
<input checked="" type="checkbox"/> Falls	<input checked="" type="checkbox"/> Power equipment/tools	<input type="checkbox"/> Elevated work surfaces	<input type="checkbox"/> _____			
Eye Hazards						
<input checked="" type="checkbox"/> Particulates	<input type="checkbox"/> Liquid splashes	<input type="checkbox"/> Welding Arc	<input type="checkbox"/> _____			
Hearing Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Impact noise	<input checked="" type="checkbox"/> High frequency noise	<input type="checkbox"/> High ambient noise			
Respiratory Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Dust/particulates	<input type="checkbox"/> Organic Vapors	<input type="checkbox"/> Acid Gases	<input type="checkbox"/> Radon	<input type="checkbox"/> Asbestos	<input type="checkbox"/> Be, Hg, Cr, Pb
<input type="checkbox"/> Oxygen deficient	<input type="checkbox"/> Welding fumes	<input type="checkbox"/> Aerosols/Particulates	<input type="checkbox"/> _____			
Chemical Hazards						
<input type="checkbox"/> None	<input type="checkbox"/> Organic solvents	<input type="checkbox"/> Reactive metals	<input type="checkbox"/> PCBs			
<input type="checkbox"/> Acids / bases	<input type="checkbox"/> Oxidizers	<input type="checkbox"/> Volatiles / Semi-volatiles	<input checked="" type="checkbox"/> See HASP _____			
Environmental Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Temperature extremes: <input type="checkbox"/> Cold <input type="checkbox"/> Heat	<input type="checkbox"/> Wet location	<input type="checkbox"/> Explosive vapors	<input type="checkbox"/> Confined space	<input type="checkbox"/> Engulfment Hazard	
<input checked="" type="checkbox"/> Bio hazards (poisonous plants, insects, animals, animal droppings, mold, fungus, etc.)			<input type="checkbox"/> _____			
Electrical Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Overhead utilities	<input type="checkbox"/> Underground utilities	<input type="checkbox"/> Hidden utilities	<input type="checkbox"/> Energized equip/circuits	<input type="checkbox"/> Wet location	
Fire Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Cutting, welding, or grinding generated sparks or heat sources	<input checked="" type="checkbox"/> Flammable materials present	<input type="checkbox"/> Oxygen enriched location			
Ergonomic Hazards						
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Lifting	<input checked="" type="checkbox"/> Bending	<input checked="" type="checkbox"/> Twisting	<input checked="" type="checkbox"/> Pulling/tugging	<input type="checkbox"/> Repetitive motion	
Computer Use in the:	<input type="checkbox"/> Office	<input type="checkbox"/> Field	<input type="checkbox"/> _____			
Radiological Hazards						
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Loose contamination	<input type="checkbox"/> Fixed Contamination	<input type="checkbox"/> Airborne contamination	<input type="checkbox"/> Radiation	<input type="checkbox"/> Radon	
<input type="checkbox"/> Alpha	<input type="checkbox"/> Beta	<input type="checkbox"/> Gamma/X-rays	<input type="checkbox"/> Neutron	<input type="checkbox"/> EMF	<input type="checkbox"/> Criticality	<input type="checkbox"/> Tritium <input type="checkbox"/> TRU
<input type="checkbox"/> Depleted Uranium	<input type="checkbox"/> Enriched Uranium	<input type="checkbox"/> _____		<input type="checkbox"/> _____		
Other Hazards						
<input type="checkbox"/>						

Completed by: Douglas Saigh Date: 07/27/11

CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
 Owner: H.J. Gordon Approver: S. D. Rima PAGE 6 OF 6

PPE and Monitoring Requirements

Standard PPE					
<input checked="" type="checkbox"/> Hard Hat	<input checked="" type="checkbox"/> Safety shoes	<input checked="" type="checkbox"/> Safety glasses	<input type="checkbox"/> Boot Covers	<input type="checkbox"/> Rubber Boots	<input type="checkbox"/> High Visibility Vest
Eye and Face Protection					
<input type="checkbox"/> Welding glasses	<input type="checkbox"/> Welding helmet	<input type="checkbox"/> Face shield	<input type="checkbox"/> Chemical goggles	<input type="checkbox"/> Welding screens	
Hearing Protection					
<input checked="" type="checkbox"/> Ear plugs	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Ear plugs and muffs	<input type="checkbox"/> Other _____		
Respiratory Protection					
<input type="checkbox"/> None	<input type="checkbox"/> Upgrade Only	<input type="checkbox"/> Full Face APR	<input type="checkbox"/> Half Face APR	Cart. Type _____	<input type="checkbox"/> PAPR
<input type="checkbox"/> Airline respirator	<input type="checkbox"/> SCBA	<input checked="" type="checkbox"/> Dust mask		<input type="checkbox"/> _____	
Protective Clothing					
<input type="checkbox"/> Tyvek® coveralls	<input type="checkbox"/> Poly-coated Tyvek® Coveralls	<input type="checkbox"/> Saranex® Coveralls	<input type="checkbox"/> Fully encapsulating suit	<input type="checkbox"/> Apron	
<input type="checkbox"/> Cotton coveralls	<input type="checkbox"/> Modesty Clothing	<input type="checkbox"/> Fire resistant clothing	<input type="checkbox"/> Other _____		
Hand Protection					
<input type="checkbox"/> None	<input type="checkbox"/> Cotton gloves	<input checked="" type="checkbox"/> Leather gloves	<input type="checkbox"/> Cut-resistant gloves	<input type="checkbox"/> Glove liners	
Outer Gloves					
<input type="checkbox"/> Nitrile	<input type="checkbox"/> Viton®	<input type="checkbox"/> Butyl	<input type="checkbox"/> Neoprene	<input type="checkbox"/> Other _____	
Inner Gloves					
<input type="checkbox"/> Nitrile	<input type="checkbox"/> Vinyl	<input type="checkbox"/> Latex	<input type="checkbox"/> Other _____		
Other Required PPE					
<input type="checkbox"/> Personal Flotation Device	<input type="checkbox"/> Waders _____	<input checked="" type="checkbox"/> Chaps _____	<input type="checkbox"/> _____		
Monitoring Requirements					
<input type="checkbox"/> Oxygen	<input type="checkbox"/> Flammable gases/vapors	<input type="checkbox"/> Toxic Gas/vapors	<input type="checkbox"/> Hydrogen Sulfide	<input type="checkbox"/> Carbon Monoxide	
<input type="checkbox"/> Asbestos	<input type="checkbox"/> Full time IH coverage	<input type="checkbox"/> Part time IH coverage	<input type="checkbox"/> Be, Hg, Cr, Pb		
<input type="checkbox"/> Metals Specify: _____					
<input type="checkbox"/> Organic Vapors Specify: _____					
<input type="checkbox"/> None	<input type="checkbox"/> TLD required	<input type="checkbox"/> CAM	<input type="checkbox"/> Radon		
<input type="checkbox"/> Full time RCT coverage	<input type="checkbox"/> Part time RCT coverage	<input type="checkbox"/> Radioactive air particulates	<input type="checkbox"/> Other _____		
<input type="checkbox"/> Other _____		<input type="checkbox"/> Other _____			

PPE and monitoring requirements completed by: Douglas Saigh Date: 07/27/11

CORPORATE ES&H PROCEDURE

Issued: **9/10/08** Effective: **9/10/08**
 Owner: **R. Brown** Approver: **K. Book** **PAGE 1 OF 5**

Job Hazard Analysis Form

JHA No.: JHA - Novi - 014 - 11 - 01

Job Title: Working Near Water

Date of Analysis: 10/07/11

Job Location: Honeywell Lake Linden-C&H Power Plant Site

Project Manager: Dan Dyer

Instructions: The Team Leader will gather the appropriate team, including subject matter experts, operators, and support personnel, to analyze the job for hazards. Using the below table or similar format, address the three phases of this process:

- **Identify Key Job Steps:** Break the job down into individual key steps where work activities are presented in sequential order.
- **Identify Job Hazards:** Create a list of known or potential hazards within each step of the job. Consider hazards associated with the various tools, equipment or other hardware involved in the job. Consider environmental hazards such as thermal stress, biohazards, etc.
- **Identify Safe Practices and Equipment:** List one or more prevention or control measures to address each hazard identified, emphasizing engineering and administrative controls over PPE. Once this has been completed, the JHA Team will determine whether the job can be performed in a manner that eliminates the identified hazards.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Field Work Near Water	1A) Slips, trips, falls	1A) Familiarize self with site prior to visit. <ul style="list-style-type: none"> ▪ Complete appropriate training before going on site. ▪ Provide appropriate person in district office your itinerary. ▪ Prepare listing of emergency phone numbers, both on and offsite. ▪ Identify site/activity PPE needs. ▪ Ensure that First Aid training is current, and that tetanus booster is current. ▪ Be aware of your surroundings
	1B) Falling into water	1B) Falling into water and capsize <ul style="list-style-type: none"> ▪ Use equipment that facilitates reaching the location from a safe distance (extensions, etc.). ▪ Work using the buddy system. ▪ Wear PFD when working on or near the water. ▪ Avoid leaning over edge of land to water. ▪ Anchor or secure yourself to a permanent and secure structure when working near water.

CORPORATE ES&H PROCEDURE

Issued: **9/10/08** Effective: **9/10/08**

Owner: **R. Brown** Approver: **K. Book** **PAGE 2 OF 5**

	<p>1C) Vermin, leaches, Insect/animal born disease</p>	<p>1C) Vermin, leaches, Insect/animal born disease</p> <ul style="list-style-type: none"> ▪ Survey the area for dens, nests, etc. ▪ Identify areas where biological hazards may be present. ▪ Be aware of your surroundings. ▪ Wear insect netting clothing or apply insect repellent on all exposed skin surfaces as appropriate – consider sample contamination. ▪ Wear appropriate footwear (snake boots, etc.) ▪ Avoid high grass areas along shoreline if possible. ▪ Tuck pants leg into boot. ▪ Do not put hand/arm into/under an area that you can not see into/under clearly. ▪ Do not touch any suspected contaminant without appropriate hand PPE. ▪ Wash hands as soon as possible upon completion of task. ▪ Perform routine inspections for ticks, leaches, etc. of yourself and co-workers. ▪ Contract vermin relocation, if applicable. ▪ Remain vigilant and respectful of wildlife. (See JHA for Insects, Stings and Bites, and JHA for Dog – Wildlife Safety. ▪ Wear wind impervious outerwear ▪ During warm months – wear a long sleeve cotton/breathable fabric shirt and pants.
	<p>1D) Bending, pulling, twisting</p>	<p>1D) Bending, pulling, twisting</p> <ul style="list-style-type: none"> ▪ Balance weight in the boat with other personnel and equipment. ▪ Use a vibrating or wiggling motion on the sample device to break the sediment suction. ▪ Attach recovery line to sample equipment prior to deploying equipment. ▪ Proper lifting technique. ▪ Do not lean outside the boat.

CORPORATE ES&H PROCEDURE

Issued: **9/10/08** Effective: **9/10/08**

Owner: **R. Brown** Approver: **K. Book** **PAGE 4 OF 5**

JOB HAZARD ANALYSIS FORM

Environmental Hazards			
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Temperature extremes	<input checked="" type="checkbox"/> Wet location	<input checked="" type="checkbox"/> Bio hazards (snakes, insects, spiders, bird / mouse droppings, fungus, etc.)
<input type="checkbox"/> Explosive vapors	<input type="checkbox"/> Confined space	<input type="checkbox"/> Engulfment Hazard	<input type="checkbox"/> _____
Electrical Hazards			
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Energized equipment or circuits	<input type="checkbox"/> Overhead utilities <input type="checkbox"/> Underground utilities <input type="checkbox"/> Hidden utilities	<input type="checkbox"/> Wet location
Fire Hazards			
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cutting, welding, or grinding generated sparks or heat sources	<input type="checkbox"/> Flammable materials present (Optional gasoline/diesel fuel)	<input type="checkbox"/> Oxygen enriched location
Ergonomic Hazards			
<input checked="" type="checkbox"/> Lifting	<input checked="" type="checkbox"/> Bending	<input checked="" type="checkbox"/> Twisting	<input checked="" type="checkbox"/> Pulling/tugging
Computer Use in the: <input type="checkbox"/> Office <input type="checkbox"/> Field	<input checked="" type="checkbox"/> Repetitive motion	<input type="checkbox"/> _____	<input type="checkbox"/> _____
Radiological Hazards			
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Loose contamination	<input type="checkbox"/> Fixed Contamination	<input type="checkbox"/> Radiation
<input type="checkbox"/> Airborne contamination	<input type="checkbox"/> Radon	<input type="checkbox"/> EMF	<input type="checkbox"/> Criticality
<input type="checkbox"/> Alpha	<input type="checkbox"/> Beta	<input type="checkbox"/> Gamma/X-rays	<input type="checkbox"/> Neutron
<input type="checkbox"/> Tritium	<input type="checkbox"/> TRU	<input type="checkbox"/> Depleted Uranium	<input type="checkbox"/> Enriched Uranium
Other Hazards			
<input type="checkbox"/>			

Completed by: Douglas Saigh

Date: 10/07/11

CORPORATE ES&H PROCEDURE

Issued: **9/10/08** Effective: **9/10/08**

Owner: **R. Brown** Approver: **K. Book** **PAGE 5 OF 5**

Job Hazard Analysis Form

PPE and Monitoring Requirements

Standard PPE			
<input checked="" type="checkbox"/> Hard Hat	<input checked="" type="checkbox"/> Safety shoes	<input checked="" type="checkbox"/> Safety glasses	<input checked="" type="checkbox"/> Boot Covers
<input type="checkbox"/> Aprons	<input checked="" type="checkbox"/> Rubber Boots (Optional)	<input checked="" type="checkbox"/> Other: <u>PFD</u>	<input checked="" type="checkbox"/> Other: <u>Waders (shoreline)</u>
Eye Protection			
<input type="checkbox"/> Welding glasses <input type="checkbox"/> Welding helmet	<input type="checkbox"/> Face shield	<input type="checkbox"/> Chemical goggles	<input type="checkbox"/> Welding screens
Hearing Protection			
<input type="checkbox"/> Ear plugs	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Ear plugs and muffs	<input type="checkbox"/> Other _____
Respiratory Protection			
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Dust mask	<input type="checkbox"/> Full Face APR <input type="checkbox"/> Half Face APR Cart. Type _____	<input type="checkbox"/> PAPR Cart. Type _____
<input type="checkbox"/> SCBA	<input type="checkbox"/> Airline respirator	<input type="checkbox"/> _____	<input type="checkbox"/> _____
Protective Clothing			
<input checked="" type="checkbox"/> Tyvek® coveralls (optional)	<input type="checkbox"/> Poly-coated Tyvek® Coveralls	<input type="checkbox"/> Saranex® Coveralls	<input type="checkbox"/> Fully encapsulating suit
<input type="checkbox"/> Cotton coveralls	<input type="checkbox"/> Modesty Clothing	<input type="checkbox"/> Fire resistant clothing	<input checked="" type="checkbox"/> Other <u>Rain gear</u>
Hand Protection			
<input type="checkbox"/> None	<input type="checkbox"/> Cotton gloves	<input type="checkbox"/> Leather gloves	<input type="checkbox"/> Glove liners
<input checked="" type="checkbox"/> Nitrile gloves <input type="checkbox"/> Viton® gloves <input type="checkbox"/> Butyl gloves <input type="checkbox"/> Neoprene gloves	Surgical gloves <input type="checkbox"/> Latex <input type="checkbox"/> Non-Latex	<input type="checkbox"/> Cut-resistant gloves	<input type="checkbox"/> Other _____
Monitoring Requirements			
<input type="checkbox"/> Oxygen	<input type="checkbox"/> Flammable gases/vapors	<input type="checkbox"/> Toxic Gas/vapors	<input type="checkbox"/> Hydrogen Sulfide/Carbon Monoxide
<input type="checkbox"/> Asbestos	<input type="checkbox"/> Full time IH coverage	<input type="checkbox"/> Part time IH coverage	<input type="checkbox"/> Be, Hg, Cr, Pb
<input type="checkbox"/> Metals Specify: _____			
<input type="checkbox"/> Organic vapors Specify: _____			
<input type="checkbox"/> Radioactive air particulates	<input type="checkbox"/> TLD required	<input type="checkbox"/> CAM	<input type="checkbox"/> Radon
<input type="checkbox"/> Full time RCT coverage	<input type="checkbox"/> Part time RCT coverage	<input type="checkbox"/> Radioactive air particulates	<input type="checkbox"/> Other _____
<input type="checkbox"/> Other _____		<input type="checkbox"/> Other _____	

PPE and monitoring requirements completed by: Douglas Saigh Date: 10/07/11

APPENDIX F

DECONTAMINATION PROCEDURES & EQUIPMENT PER TASK

APPENDIX F1

DECONTAMINATION PROCEDURES & EQUIPMENT

Task(s) Equipment Decontamination
Decontamination Solution: Detergent and Water

LEVEL D		
Station 1:	Equipment Drop	Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, etc. on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, a cool-down station may be set up within this area.
Station 2:	Outer Boots, and Gloves Wash and Rinse (if worn)	Scrub outer boots, and outer gloves decon solution or detergent water. Rinse off using copious amounts of water.
Station 3:	Outer Boot and Glove Removal (if worn)	Remove outer boots and gloves. Deposit in plastic bag.
Station 4:	Inner glove removal	Remove inner gloves and place in plastic bag.
Station 5:	Field Wash	Hands and face are thoroughly washed. Shower as soon as possible.

APPENDIX F2

DECONTAMINATION PROCEDURES & EQUIPMENT

Task(s) Equipment Decontamination
Decontamination Solution: Detergent and Water

MODIFIED LEVEL D & LEVEL C		
Station 1:	Equipment Drop	Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, etc. on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, a cool-down station may be set up within this area.
Station 2:	Outer Garment, Boots, and Gloves Wash and Rinse	Scrub outer boots, outer gloves, and splash suit with decon solution or detergent water. Rinse off using copious amounts of water.
Station 3:	Outer Boot and Glove Removal	Remove outer boots and gloves. Deposit in container with plastic liner.
Station 4: (Level C only)	Canister or Mask Change	If worker leaves exclusion zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers are donned, joints are taped, and worker returns to duty.
Station 5:	Boot, Gloves and Outer Garment Removal	Boots, chemical resistant splash suit, and inner gloves are removed and deposited in separate containers lined with plastic.
Station 6: (Level C only)	Face Piece Removal	Facepiece is removed. Avoid touching face with fingers. Facepiece is deposited on plastic sheet.
Station 7:	Field Wash	Hands and face are thoroughly washed. Shower as soon as possible.

APPENDIX F3

DECONTAMINATION PROCEDURES AND EQUIPMENT

Task(s) Equipment Decontamination
Decontamination Solution: Detergent and Water

LEVEL B		
Station 1:	Equipment Drop	Deposit equipment used on site (tools, sampling devices and containers, monitoring instruments, radios, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, a cool-down station may be set up within this area.
Station 2:	Outer Garment, Boots, and Gloves Wash and Rinse	Scrub outer boots, outer gloves, and splash suit with decon solution or detergent water. Rinse off using copious amounts of water.
Station 3:	Outer Boot and Glove Removal	Remove outer boots and gloves. Deposit in container with plastic liner.
Station 4:	Tank Change	If worker leaves exclusion zone to change air tank, this is the last step in the decontamination procedure. Worker's air tank is exchanged, new outer gloves and boot covers are donned, joints are taped, and worker returns to duty.
Station 5:	SCBA Backpack, Boot, Gloves and Outer Garment Removal	SCBA backpack is removed and placed on plastic sheets. Boots, chemical resistant splash suit, and inner gloves are removed and deposited in separate containers lined with plastic.
Station 6:	Face Piece Removal	SCBA face-piece is removed. Avoid touching face with fingers. Facepiece is deposited on plastic sheet.
Station 7:	Field Wash	Hands and face are thoroughly washed. Shower as soon as possible.

APPENDIX G
INCIDENT ANALYSIS FORMS

CORPORATE HSE PROCEDURE



Issued: 4/5/11 Effective: 4/11/11 ESH-2.0.1 REVISION 3
Owner: H.J. Gordon Approver: A. E. Massey PAGE 11 OF 17

ATTACHMENT 2

VEHICLE INCIDENT REPORT

Attorney-Client Work Product Prepared in Anticipation of Litigation

(Review instructions on page 15 prior to completing this form)

Section 1 - General Information

Date of Incident: _____ Time incident occurred: _____ AM | PM
Illumination: Dark | Dusk | Light Road Condition: Dry | Wet | Icy/snow
Were police summoned to scene?: Yes | No Police Department and Location: _____
Report #: _____ Officer's Name and Badge Number: _____

Section 2 - Company Driver and Vehicle

Driver's name: _____ D/L #: _____ State: _____
Driver's home office address: _____ Driver's Phone #: _____
Company Vehicle #: _____ Year: _____ Model: _____ License #: _____ State: _____
Company car?: Yes | No Owned by employee?: Yes | No
Leased/rented from _____
Passenger/Witness Name(s): _____ Address: _____ Telephone: _____
Passenger/Witness Name(s): _____ Address: _____ Telephone: _____

Damage to vehicle: _____

Injuries to employee(s): _____

Injuries to others: _____

Vehicle was being used for: Company business: Yes | No Personal business: Yes | No

Towed: Yes | No By Whom: _____ To Where: _____

Section 3 - Other Driver and Vehicle Information

Driver's name: _____ D/L #: _____ State: _____
Current Address: _____ City: _____ State: _____
Telephone: _____ Work: _____ Cell: _____
Registered Owner's Name: _____ Address: _____ City: _____ State: _____
(verify registration document)
The Other Vehicle: Make: _____ Model: _____ Year: _____ License #: _____ State: _____

CORPORATE HSE PROCEDURE

Issued: 4/5/11 Effective: 4/11/11 ESH-2.0.1 REVISION 3
Owner: H.J. Gordon Approver: A. E. Massey PAGE 12 OF 17

Insurance company name: _____ Address: _____ Phone #: _____
Policy No.: _____ Contact Person: _____ Phone #: _____
Passenger/Witness Name(s): _____ Address: _____ Telephone: _____
Passenger/Witness Name(s): _____ Address: _____ Telephone: _____

Damage: (Make note of pre-existing damage and take pictures if possible. Attach additional pages as needed): _____

Injuries to other driver/passengers: _____

Section 4 – Approvals (signatures required)

Form completed by: _____ Signature: _____ Date: _____
Please Print

Office/Project Manager: _____ Signature: _____ Date: _____
Please Print

Things to Do First In The Event Of a Motor Vehicle Incident

1. Most important: **STOP.**
2. **Call 911 if there are injuries.**
3. Call for an officer if the incident occurred on public property (streets, highways or roads). Disputes often arise between the parties involved as to who was at fault; therefore, a police report is important. If an officer is unable to attend the scene of the accident, a counter police report may be filed at most stations. Insurance companies rely on police reports to determine liability.
4. Complete the Incident Investigation Report and the Vehicle Incident Report forms. It is important that both these forms are completed in detail. Include a diagram of the incident on the provided sheet. Incomplete information may lead to delays in processing associated claims and in helping to prevent this type of incident from occurring again.
5. Express no opinion as to who was at fault. This is for the insurance companies to determine.
6. Give only information that is required by the authorities or as directed by AMEC contractual requirements.
7. Sign only those statements required by the authorities or as directed by AMEC contractual requirements. Do not sign away your rights or the company's rights.
8. If you are injured or think you were injured, tell your supervisor and see a physician. Your supervisor will notify AMEC's Worker's Compensation insurance carrier, your Regional HSE Manager and the Corporate Director of HSE by phone, email or fax. For additional instructions on what to do, go to AMEC's HSE website on the intranet at:
<http://am.amecnet.com/fn/SHE/167.aspx>
9. Your supervisor will forward both completed incident reports immediately to your Regional HSE Manager.

Please insert additional information or pictures in this field.

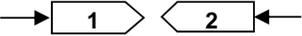
CORPORATE HSE PROCEDURE

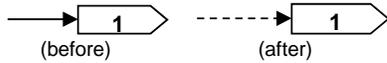
Issued: 4/5/11 Effective: 4/11/11 ESH-2.0.1 REVISION 3
Owner: H.J. Gordon Approver: A. E. Massey PAGE 12 OF 17

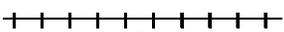
Vehicle Incident Diagram

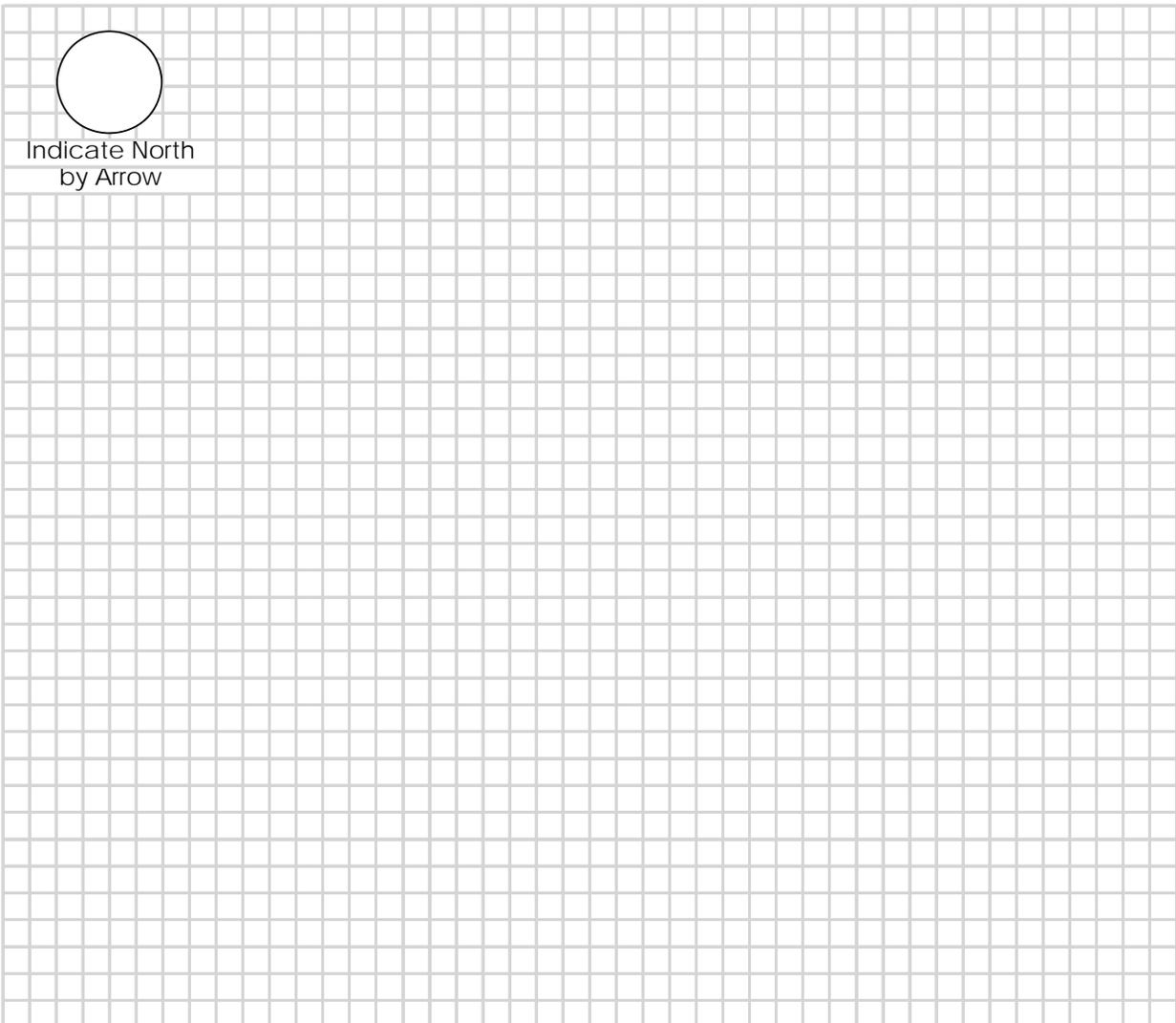
(This or a similar diagram must be completed with all VIRs)

Instructions:

1. Number each vehicle and show directions 
2. Use a solid line to show path before incident and use a dotted line to show path after incident



3. Show pedestrian/non-motorist by: 
4. Show railroad by: 
5. Indicate north by arrow as: 
6. Show street or highway names or numbers
7. Show signs, signals, warning and traffic controls.



Indicate North
by Arrow

Prepared by: _____ Date: _____

CORPORATE ES&H PROCEDURE



Issued: 4/5/11 Effective: 4/11/11 ESH-2.0.1 REVISION 3
Owner: H.J. Gordon Approver: A. E. Massey PAGE 9 OF 17

ATTACHMENT 1

INCIDENT ANALYSIS REPORT

Attorney-Client Work Product Prepared in Anticipation of Litigation

(Review instructions on page 13 and 16 prior to completing this form)

Check one

Initial Report:
Update:
Final Report:

Check one

Category C:
Category B:
Category A:

Local Office ID Number:

To: Office of the General Counsel

This information has been prepared at your request and under your direction in anticipation of litigation so that you may provide appropriate legal advice to the undersigned and the management of the Company.

Section 1 – General Information

Incident Date: _____

Report Date: _____

Employee Name: _____	Sex: <input type="checkbox"/> M <input type="checkbox"/> F	Time of incident: _____	<input type="checkbox"/> AM <input type="checkbox"/> PM
Job Title: _____	Hire Date: _____	Time employee began work: _____	<input type="checkbox"/> AM <input type="checkbox"/> PM
Business Line: _____	Department: _____	Project Manager: _____	Client: _____
Office where employee works from: _____	Immediate Supervisor: _____	Hours employee worked during last 7 days: _____	hrs
Location where incident occurred: _____	Is this a Company controlled work site: <input type="checkbox"/> Yes <input type="checkbox"/> No		

Section 2 – Incident Type (mark all that apply)

A. Type of incident being reported:

- Near Miss First-aid case Medical treatment Hospitalization Fatality
 Day Away Case Restricted/Transfer Case Vehicle Incident
 Environmental Release Regulatory Inspection Notice of Violation
 Other (please describe): _____

B. If an **injury or illness**: describe the part of the body that was affected and how it was affected:

C. If an **environmental release**: describe the quantity and name and CAS# of material released into the environment:

D. If an **inspection by a regulatory agency**, what agency, who were the inspectors, inspector contact information:

Section 3 – Incident Description

Attach and number additional pages, as needed, to ensure **all details related to the incident are captured**.

- A. List the names of all persons involved in the incident, and employer information:
B. List the names of any witnesses, their employer, and a local/company telephone number or address:
C. What was the employee(s) doing just prior to the incident:
D. Explain in **detail** what happened:
E. Explain in **detail** what object or substance directly harmed the employee:
F. List any damaged equipment or property (other than motor vehicles) model and serial number **and** estimated costs to repair/replace damaged equipment or property, if applicable:

Section 4 - Incident Analysis

- A. Was a Job Hazard Analysis (JHA) completed for the work being performed? YES | NO Who prepared the JHA?:
B. When and who was the last safety officer (i.e. LHSR, supervisor, Division ES&H Manager, etc.) at the site of the incident:
C. When and what safety training **directly related** to the incident has the person(s) involved had?

CORPORATE ES&H PROCEDURE

Issued: **4/5/11** Effective: **4/11/11** **ESH-2.0.1 REVISION 3**
 Owner: **H.J. Gordon** Approver: **A. E. Massey** **PAGE 10 OF 17**

Section 5 - Incident Investigation Results

#	Causal Factors (Attach and number any additional pages as needed to completely address this section)				
1					
2					
3					
4					
5					
Root Cause(s) Analysis (The below items represents major root cause categories which have been determined to be Less Than Adequate (LTA). A more detailed determination of the root cause will be facilitated, if needed, by the applicable Regional ES&H Manager)					
1. Equipment Reliability Program Implementation 2. Administrative / Management Systems 3. Procedures 4. Human Factors Engineering			5. Training 6. Immediate Supervision 7. Communications 8. Personal Performance		
Root Cause #	Corrective Actions to be taken (Attach additional pages as needed to completely address this section)	Responsible Person	Proposed Completion Date	Closed on Date	Verified by and Date Verified

Section 6 – Notifications, Certification & Approvals

Check the appropriate boxes indicating the applicable reports have been made to the following applicable organizations:

Auto Lessor: | **Insurer:** | **Workers' Compensation Administrator:**
Post-incident Substance Abuse Testing Has Been Performed:

Incident investigated by:	
Employee (s): Date:	Employee's Supervisor: Date:
LHSR/Project/Office Manager: Date:	Regional ES&H Manager: Date:

Please insert additional information or pictures in this field.

APPENDIX H
SPILL CONTROL PLAN

APPENDIX H

AMEC SPILL CONTROL PLAN

When working around containers of bulk chemicals (e.g., drums or tanks), every effort should obviously be made to avoid damaging the container, which would discharge the contents and further contaminate the area. However, in the unlikely event that an accident does occur, a Spill Control Plan must be developed based on site contaminants and conditions, and the precautions that need to be taken to control and minimize the effects of the spill. Personnel must be trained and have adequate equipment to be able to contain or control a spill, plus be able to decontaminate previously uncontaminated structures, equipment, or material. In addition, spilled materials and contaminated soils and/or water must be collected, containerized, and disposed of properly.

Some equipment that may be needed in addition to personal protective equipment include: sand, "kitty litter," or some other absorbent material; sandbags; a front-end loader; DOT-approved 55-gallon drums or salvage drums; shovels; drum repair kit; chemicals to neutralize acids or bases; or decontamination equipment. The choice of equipment needed for the site is based on the amount and type of contaminants known or suspected to be at the site, as well as the work to be conducted.

Personal Protective Equipment

In the event of a spill or leak, the work crew must back off until adequate personal protective equipment can be donned. In most cases, Level B personal protective equipment will be required; however, there may be incidences where Level C or D is acceptable. The SSHO will determine the level of protection based on the contaminant, amount spilled, and levels monitored in the air.

Control Measures

Once the work crew is adequately protected, immediate measures should be taken to control and contain the spill within site boundaries. The hazardous area should be isolated and all unnecessary personnel kept away and upwind of the spill. Do not allow any flares, smoking, or open flames into the area and, if possible, avoid allowing combustible materials to come in contact with the spill.

Small Spills. If the spilled material is a solid, shovel contaminated material directly into a container, then cover, label, and dispose of it properly. If the spilled material is a liquid, absorb with sand, "kitty litter," or some other noncombustible absorbent material first, then shovel it into a container, and cover, label, and dispose of it properly.

Large Spills. For large liquid spills, install a dike using sandbags, absorbent pillows, soil, or any other available, noncombustible material. Ensure that the dike is large enough to contain the spill. Pump off and containerize any standing liquid. Recycle it if possible, or solidify it with an absorbent material, then cover, label, and dispose of it properly. Collect and containerize all contaminated soil, then cover, label, and dispose of it properly. For large solid spills, collect, containerize, cover, label, and dispose of it properly.

GENERAL MATERIALS CLEANUP PROCEDURES

Acids (Forklift Battery, etc.) [Refer: Spilfyter® Product NO. 440133 Spill Kit Instructions]

1. Evacuate employees from spill area.
2. Personal protective equipment (PPE) must be worn for cleanup (supplied in spill kit). At a minimum, PPE includes safety goggles, gloves, safety apron or similar protective clothing.
3. Ventilate the contaminated area.
4. Spray the spill with COLOR-SAFE® Liquid Acid Neutralizer until the spill is pink in color as indicated on the neutralizer bottle. The pink color signifies neutralization of the spill.
5. Once the spill is neutralized, sprinkle AQUALOCKIT® onto the spill. The spill will gel for easy clean-up.
6. Use the scoop with detachable scraper to collect the gelled spill and place gelled material in the temporary disposal bag.
7. Use the HAZMAT pads to absorb any remaining neutralized spill and place used pads in the temporary disposal bag.
8. Dispose of all materials in accordance with local, state, and federal regulations.

Depending upon the size and extent of the spill additional equipment may be needed. Report spill to appropriate internal managers.

NOTE: Use caution handling spill and spill cleanup materials. If acid has contacted the skin, flush for a minimum of 15 minutes with water. Remove all contaminated clothing and discard or flush clothing with water. Follow MSDS for spilled material handling and additional cleanup directions.

Oil Substances (Hydraulic Oils, Cutting Oils, etc.)

1. Evacuate employees from spill area.
2. Personal protective equipment (PPE) must be worn for cleanup. At a minimum, PPE includes safety goggles, gloves, safety apron or similar protective clothing.
3. Shut off source taking normal safety precautions. Confine spill immediately. Take measures to prevent material from entering sewers, water sources or low lying areas and minimize the effects on surface and ground water.
4. Recover by pumping or scraping up the product. Contain spilled material with sand or other suitable absorbent and remove mechanically into containers.
5. Clean residue from spill surface using suitable petroleum solvent or absorbent.
6. Ventilate the contaminated area for oil and/or solvent fumes.
7. Dispose of residues and cleanup materials in accordance with local, state, and federal regulations.

Report spills/releases to management who will report as required to appropriate authorities as necessary. U.S. Coast Guard and EPA regulations require immediate reporting of spills/releases that could reach any waterway (e.g. visual sheen) including intermittent dry creeks.

Gases (Acetylene, Propane, Nitrogen, etc.)

1. Evacuate employees from exposure area. (Explosive mixtures may be created with release of acetylene and air.) Before entering an area where a dangerous gas may be present, especially in confined spaces, check atmosphere with appropriate device.
2. Personal protective equipment (PPE) must be worn for cleanup according to the Material Safety Data Sheet (MSDS).
3. Remove sources of ignition if possible without additional risk.
4. Shut off material flow if possible without additional risk.

5. Ventilate the area or move leaking cylinder to a well ventilated areas.
6. Discard any product, residue and container in compliance with federal, state and local regulations. Contact supplier for assistance.

Report spill to appropriate internal managers. Refer to the product MSDS for additional safety and cleanup measures.

Flammable Liquid (Acetone, etc.)

1. Evacuate employees from exposure area and isolate the hazard area. (Explosive/Flammable hazardous conditions may be created.) Before entering an area where dangerous atmospheres may be present, especially in confined spaces, check atmosphere with appropriate device.
2. Personal protective equipment (PPE) must be worn for cleanup according to the Material Safety Data Sheet (MSDS). At a minimum, PPE includes safety goggles, gloves, safety apron or similar protective clothing.
3. Ventilate the area of the leak or spill.
4. Remove sources of ignition if possible without additional risk.
5. Stop material flow if possible without additional risk.
6. Contain and recover liquid when possible. Use non-sparking tools and equipment.
7. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer!
8. Discard any product, residue and container in compliance with federal, state and local regulations. Contact supplier for assistance.

Refer the MSDS for additional safety, fire and cleanup information.

Report spills/releases to management who will report as required to appropriate authorities as necessary

Reporting

If the amount spilled is reportable under Resource Conservation and Recovery Act (RCRA) requirements and goes off-site, or if there is a threat to human health or the environment, the proper authorities must be notified. The HASP will list the agencies to be notified in the event of an emergency.

APPENDIX I

MATERIAL SAFETY DATA SHEETS

ALCONOX MSDS

Section 1 : MANUFACTURER INFORMATION

Product name: Alconox

Supplier: Same as manufacturer.

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Manufacturer emergency 800-255-3924.

phone number: 813-248-0585 (outside of the United States).

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Supplier MSDS date: 2005/03/09

D.O.T. Classification: Not regulated.

Section 2 : HAZARDOUS INGREDIENTS

C.A.S.	CONCENTRATION %	Ingredient Name	T.L.V.	LD/50	LC/50
25155-30-0	10-30	SODIUM DODECYLBENZENESULFONATE	NOT AVAILABLE	438 MG/KG RAT ORAL 1330 MG/KG MOUSE ORAL	NOT AVAILABLE
497-19-8	7-13	SODIUM CARBONATE	NOT AVAILABLE	4090 MG/KG RAT ORAL 6600 MG/KG MOUSE ORAL	2300 MG/M3/2H RAT INHALATION 1200 MG/M3/2H MOUSE INHALATION
7722-88-5	10-30	TETRASODIUM PYROPHOSPHATE	5 MG/M3	4000 MG/KG RAT ORAL 2980 MG/KG MOUSE ORAL	NOT AVAILABLE
7758-29-4	10-30	SODIUM PHOSPHATE	NOT AVAILABLE	3120 MG/KG RAT ORAL 3100 MG/KG MOUSE ORAL >4640 MG/KG RABBIT DERMAL	NOT AVAILABLE

Section 2A : ADDITIONAL INGREDIENT INFORMATION

Note: (supplier).
 CAS# 497-19-8: LD50 4020 mg/kg - rat oral.
 CAS# 7758-29-4: LD50 3100 mg/kg - rat oral.

Section 3 : PHYSICAL / CHEMICAL CHARACTERISTICS
--

Physical state: Solid

Appearance & odor: Almost odourless.
White granular powder.

Odor threshold (ppm): Not available.

Vapour pressure (mmHg): Not applicable.

Vapour density (air= 1): Not applicable.

By weight: Not available.

Evaporation rate (butyl acetate = 1): Not applicable.

Boiling point (°C): Not applicable.

Freezing point (°C): Not applicable.

pH: (1% aqueous solution).
9.5

Specific gravity @ 20 °C: (water = 1).
0.85 - 1.10

Solubility in water (%): 100 - > 10% w/w

Coefficient of water\oil dist.: Not available.

VOC: None

Section 4 : FIRE AND EXPLOSION HAZARD DATA

Flammability: Not flammable.

Conditions of flammability: Surrounding fire.

Extinguishing media: Carbon dioxide, dry chemical, foam.
Water
Water fog.

Special procedures: Self-contained breathing apparatus required.
Firefighters should wear the usual protective gear.

Auto-ignition temperature: Not available.

Flash point (°C), method: None

Lower flammability limit (% vol): Not applicable.

Upper flammability limit (% vol): Not applicable.

Not available.

Sensitivity to mechanical impact: Not applicable.

Hazardous combustion products: Oxides of carbon (COx).
Hydrocarbons.

Rate of burning: Not available.

Explosive power: None

Section 5 : REACTIVITY DATA

- Chemical stability:** Stable under normal conditions.
- Conditions of instability:** None known.
- Hazardous polymerization:** Will not occur.
- Incompatible substances:** Strong acids.
Strong oxidizers.
- Hazardous decomposition products:** See hazardous combustion products.

Section 6 : HEALTH HAZARD DATA

- Route of entry:** Skin contact, eye contact, inhalation and ingestion.
- Effects of Acute Exposure**
- Eye contact:** May cause irritation.
- Skin contact:** Prolonged contact may cause irritation.
- Inhalation:** Airborne particles may cause irritation.
- Ingestion:** May cause vomiting and diarrhea.
May cause abdominal pain.
May cause gastric distress.
- Effects of chronic exposure:** Contains an ingredient which may be corrosive.
- LD50 of product, species & route:** > 5000 mg/kg rat oral.
- LC50 of product, species & route:** Not available for mixture, see the ingredients section.
- Exposure limit of material:** Not available for mixture, see the ingredients section.
- Sensitization to product:** Not available.
- Carcinogenic effects:** Not listed as a carcinogen.
- Reproductive effects:** Not available.
- Teratogenicity:** Not available.
- Mutagenicity:** Not available.
- Synergistic materials:** Not available.
- Medical conditions aggravated by exposure:** Not available.
- First Aid**
- Skin contact:** Remove contaminated clothing.
Wash thoroughly with soap and water.
Seek medical attention if irritation persists.
- Eye contact:** Check for and remove contact lenses.
Flush eyes with clear, running water for 15 minutes while holding eyelids open: if irritation persists, consult a physician.
- Inhalation:** Remove victim to fresh air.
Seek medical attention if symptoms persist.
- Ingestion:** Dilute with two glasses of water.
Never give anything by mouth to an unconscious person.
Do not induce vomiting, seek immediate medical attention.

Section 7 : PRECAUTIONS FOR SAFE HANDLING AND USE

Leak/Spill: Contain the spill.
Recover uncontaminated material for re-use.
Wear appropriate protective equipment.
Contaminated material should be swept or shoveled into appropriate waste container for disposal.

Waste disposal: In accordance with municipal, provincial and federal regulations.

Handling procedures and equipment: Protect against physical damage.
Avoid breathing dust.
Wash thoroughly after handling.
Keep out of reach of children.
Avoid contact with skin, eyes and clothing.
Launder contaminated clothing prior to reuse.

Storage requirements: Keep containers closed when not in use.
Store away from strong acids or oxidizers.
Store in a cool, dry and well ventilated area.

Section 8 : CONTROL MEASURES

Precautionary Measures

Gloves/Type:



Neoprene or rubber gloves.

Respiratory/Type:



If exposure limit is exceeded, wear a NIOSH approved respirator.

Eye/Type:



Safety glasses with side-shields.

Footwear/Type: Safety shoes per local regulations.

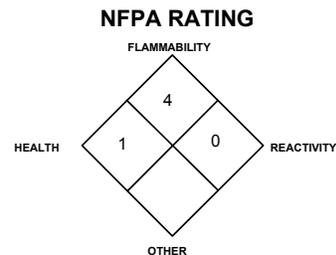
Clothing/Type: As required to prevent skin contact.

Other/Type: Eye wash facility should be in close proximity.
Emergency shower should be in close proximity.

Ventilation requirements: Local exhaust at points of emission.

MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards



PART I *What is the material and what do I need to know in an emergency?*

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS:

ISOBUTYLENE - C₄H₈

PRODUCT USE:

Document Number: 001031

For general analytical/synthetic chemical uses.

SUPPLIER/MANUFACTURER'S NAME:

AIRGAS INC.

ADDRESS:

259 N. Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283

BUSINESS PHONE:

1-610-687-5253

EMERGENCY PHONE:

CHEMTREC: 1-800-424-9300

International: 703-527-3887 (Call Collect)

DATE OF PREPARATION:

May 12, 1996

SECOND REVISION:

January 16, 1998

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA		IDLH ppm	OTHER
			TLV ppm	STEL ppm	PEL ppm	STEL ppm		
Isobutylene	115-11-7	> 99.0%	There are no specific exposure limits for Isobutylene. Isobutylene is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.					
Maximum Impurities		< 1.0%	None of the trace impurities in this mixture contribute significantly to the hazards associated with the product. All hazard information pertinent to this product has been provided in this Material Safety Data Sheet, per the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200) and State equivalent standards.					

NE = Not Established

C = Ceiling Limit

See Section 16 for Definitions of Terms Used

NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Isobutylene is a colorless, liquefied, flammable gas with an unpleasant odor similar to burning coal. The liquefied gas rapidly turns into a gas at standard atmospheric temperatures and pressures. Isobutylene is an asphyxiant and presents a significant health hazard by displacing the oxygen in the atmosphere. Rapid evaporation of liquid from the cylinder may cause frostbite. Both the liquid and gas pose a serious fire hazard when accidentally released. The gas is heavier than air and may travel to a source of ignition and flash back to a leak or open container. Flame or high temperature impinging on a localized area of a cylinder of Isobutylene can cause the cylinder to rupture without activating the cylinder's relief devices. Provide adequate fire protection during emergency response situations.

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE:
The most significant route of overexposure for this gas is by inhalation. The following paragraphs describe symptoms of exposure by route of exposure.

INHALATION: High concentrations of this gas can cause an oxygen-deficient environment. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. Under some circumstances of overexposure, death may occur. Isobutylene also has some degree of anesthetic action and can be mildly irritating to the mucous membranes. The effects associated with various levels of oxygen are as follows:

CONCENTRATION

12-16% Oxygen:

10-14% Oxygen:

6-10% Oxygen:

Below 6%:

SYMPTOMS OF EXPOSURE

Breathing and pulse rate increased, muscular coordination slightly disturbed.

Emotional upset, abnormal fatigue, disturbed respiration.

Nausea and vomiting, collapse or loss of consciousness.

Convulsive movements, possible respiratory collapse, and death.

OTHER POTENTIAL HEALTH EFFECTS: Contact with liquid or rapidly expanding gases (which are released under high pressure) may cause frostbite. Symptoms of frostbite include change in skin color to white or grayish-yellow. The pain after such contact can quickly subside.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in **Lay Terms**. Overexposure to Isobutylene may cause the following health effects:

ACUTE: The most significant hazard associated with this gas is inhalation of oxygen-deficient atmospheres. Symptoms of oxygen deficiency include respiratory difficulty, headache, dizziness, and nausea. At high concentrations, unconsciousness or death may occur. Contact with liquefied gas or rapidly expanding gases may cause frostbite.

CHRONIC: There are currently no known adverse health effects associated with chronic exposure to Isobutylene.

TARGET ORGANS: Respiratory system.

HAZARDOUS MATERIAL INFORMATION SYSTEM			
HEALTH		(BLUE)	1
FLAMMABILITY		(RED)	4
REACTIVITY		(YELLOW)	0
PROTECTIVE EQUIPMENT			B
EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8
For routine industrial applications			

See Section 16 for Definition of Ratings

PART II *What should I do if a hazardous situation occurs?*

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO ISOBUTYLENE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus and Fire-Retardant Personal Protective equipment should be worn. Adequate fire protection must be provided during rescue situations.

4. FIRST-AID MEASURES (Continued)

Remove victim(s) to fresh air as quickly as possible. Trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary. Only trained personnel should administer supplemental oxygen.

In case of frostbite, place the frostbitten part in warm water. DO NOT USE HOT WATER. If warm water is not available, or is impractical to use, wrap the affected parts gently in blankets. Alternatively, if the fingers or hands are frostbitten, place the affected area in the armpit. Encourage victim to gently exercise the affected part while being warmed. Seek immediate medical attention.

Victim(s) must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to physician or other health professional with victim(s).

5. FIRE-FIGHTING MEASURES

FLASH POINT (Closed Cup): -10°C (< 14°F)

AUTOIGNITION TEMPERATURE: 465°C (869°F)

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): 1.8%

Upper (UEL): 9.6%

FIRE EXTINGUISHING MATERIALS: Extinguish Isobutylene fires by shutting off the source of the gas. Use water spray or a foam agent to cool fire-exposed containers, structures, and equipment.

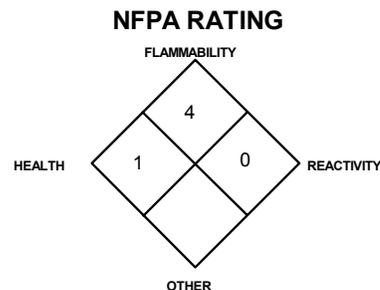
UNUSUAL FIRE AND EXPLOSION HAZARDS: When involved in a fire, this material may ignite and produce toxic gases, including carbon monoxide and carbon dioxide.

DANGER! Fires impinging (direct flame) on the outside surface of unprotected pressure storage vessels of Isobutylene can be very dangerous. Direct flame exposure on the cylinder wall can cause an explosion either by BLEVE (Boiling Liquid Expanding Vapor Explosion), or by exothermic decomposition. This is a catastrophic failure of the vessel releasing the contents into a massive fireball and explosion. The resulting fire and explosion can result in severe equipment damage and personnel injury or death over a large area around the vessel. For massive fires in large areas, use unmanned hose holder or monitor nozzles; if this is not possible, withdraw from area and allow fire to burn.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Static discharge may cause Isobutylene to ignite explosively if released.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. The best fire-fighting technique may be simply to let the burning gas escape from the pressurized cylinder, tank car, or pipeline. Stop the leak before extinguishing fire. If the fire is extinguished before the leak is sealed, the leaking gas could explosively re-ignite without warning and cause extensive damage, injury, or fatality. In this case, increase ventilation (in enclosed areas) to prevent flammable or explosive mixture formation. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Because of the potential for a BLEVE, evacuation of non-emergency personnel is essential. If water is not available for cooling or protection of vessel exposures, evacuate the area. Refer to the North American Emergency Response Guidebook for additional information. Other information for pre-planning can be found in the American Petroleum Institute Publications 2510 and 2510A.



See Section 16 for Definition of Ratings

6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a release, clear the affected area, protect people, and respond with trained personnel. Adequate fire protection must be provided. Minimum Personal Protective Equipment should be **Level B: fire-retardant protective clothing, gloves resistant to tears, and Self-Contained Breathing Apparatus.**

Use only non-sparking tools and equipment. Locate and seal the source of the leaking gas. Protect personnel attempting the shut off with water spray. Allow the gas to dissipate. Monitor the surrounding area for combustible gas levels and oxygen. Combustible gas concentration must be below 10% of the LEL (LEL = 1.8%) prior to entry. The atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus. Attempt to close the main source valve prior to entering the area. If this does not stop the release (or if it is not possible to reach the valve), allow the gas to release in place or remove it to a safe area and allow the gas to be released there.

THIS IS AN EXTREMELY FLAMMABLE GAS. Protection of all personnel and the area must be maintained.

PART III *How can I prevent hazardous situations from occurring?*

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting Isobutylene IN YOU. Do not eat or drink while handling chemicals. Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of Isobutylene could occur without any significant warning symptoms.

STORAGE AND HANDLING PRACTICES: Cylinders should be stored in dry, well-ventilated areas away from sources of heat. Compressed gases can present significant safety hazards. Store containers away from heavily trafficked areas and emergency exits. Post "No Smoking or Open Flames" signs in storage or use areas.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: Protect cylinders against physical damage. Store in cool, dry, well-ventilated area, away from sources of heat, ignition and direct sunlight. Do not allow area where cylinders are stored to exceed 52°C (125°F). Isolate from oxidizers such as oxygen, chlorine, or fluorine. Use a check valve or trap in the discharge line to prevent hazardous backflow. Post "No Smoking or Open Flame" signs in storage and use areas. Cylinders should be stored upright and be firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Never tamper with pressure relief devices in valves and cylinders. Electrical equipment should be non-sparking or explosion proof. The following rules are applicable to situations in which cylinders are being used:

Before Use: Move cylinders with a suitable hand truck. Do not drag, slide, or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap, if provided, in place until cylinder is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Use check valve or trap in discharge line to prevent hazardous backflow into the cylinder. Do not use oils or grease on gas-handling fittings or equipment.

After Use: Close main cylinder valve. Replace valve protection cap, if provided. Mark empty cylinders "EMPTY".

NOTE: Use only DOT or ASME code containers. Earth-ground and bond all lines and equipment associated with Isobutylene. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information refer to the Compressed Gas Association Pamphlet P-1, *Safe Handling of Compressed Gases in Containers*. Additionally, refer to CGA Bulletin SB-2 "Oxygen Deficient Atmospheres".

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely. Purge gas handling equipment with inert gas (e.g., nitrogen) before attempting repairs.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. Local exhaust ventilation is preferred, because it prevents Isobutylene dispersion into the work place by eliminating it at its source. If appropriate, install automatic monitoring equipment to detect the presence of potentially explosive air-gas mixtures and level of oxygen.

RESPIRATORY PROTECTION: Maintain oxygen levels above 19.5% in the workplace. Maintain level of gas below the level listed in Section 2 (Composition and Information on Ingredients). Use supplied air respiratory protection if oxygen levels are below 19.5% or during emergency response to a release of Isobutylene. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134) or equivalent State standards.

EYE PROTECTION: Splash goggles or safety glasses, for protection from rapidly expanding gases and splashes of liquid Isobutylene.

HAND PROTECTION: Wear gloves resistant to tears when handling cylinders of Isobutylene. Use low-temperature protective gloves (e.g., Kevlar) when working with containers of liquid Isobutylene.

BODY PROTECTION: Use body protection appropriate for task. Transfer of large quantities under pressure may require protective equipment appropriate to protect employees from splashes of liquefied product, as well as fire retardant items.

9. PHYSICAL and CHEMICAL PROPERTIES

VAPOR DENSITY @ 21.1°C (70°F): 2.396 kg/m³ (0.1496 lb/ft³) pH: Not applicable.
SPECIFIC GRAVITY (air = 1): 1.997 FREEZING POINT: -140°C (-220.6°F)
SOLUBILITY IN WATER: Insoluble. BOILING POINT @ 1 atm: -6.9°C (19.6°F)
EVAPORATION RATE (nBuAc = 1): Not applicable. EXPANSION RATIO: Not applicable
ODOR THRESHOLD: Not established. VAPOR PRESSURE (psia): 39
COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable. SPECIFIC VOLUME (ft³/lb): 6.7

APPEARANCE AND COLOR: Colorless gas with the unpleasant odor of burning coal. The liquid is also colorless and has the same unpleasant odor of burning coal.

HOW TO DETECT THIS SUBSTANCE (warning properties): There are no distinct warning properties. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation.

10. STABILITY and REACTIVITY

STABILITY: Stable.

DECOMPOSITION PRODUCTS: When ignited in the presence of oxygen, this gas will burn to produce carbon monoxide and carbon dioxide.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Strong oxidizers (e.g., chlorine, bromine pentafluoride, oxygen, oxygen difluoride, and nitrogen trifluoride).

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials and exposure to heat, sparks, and other sources of ignition. Cylinders exposed to high temperatures or direct flame can rupture or burst.

PART IV *Is there any other useful information about this material?*

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following information is for pure Isobutylene.

ISOBUTYLENE:

LC₅₀ (rat, inhalation) = 620 g/m³/4 hours

LC₅₀ (mouse, inhalation) = 415 g/m³/2 hours

SUSPECTED CANCER AGENT: Isobutylene is not found on the following lists: FEDERAL OSHA Z LIST, NTP, IARC, CAL/OSHA, and therefore is neither considered to be nor suspected to be a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: Isobutylene may be mildly irritating to the mucous membranes. In addition, contact with rapidly expanding gases can cause frostbite to exposed tissue.

SENSITIZATION TO THE PRODUCT: Isobutylene is not known to cause sensitization in humans.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Isobutylene on the human reproductive system.

Mutagenicity: No mutagenic effects have been described for Isobutylene.

Embryotoxicity: No embryotoxic effects have been described for Isobutylene.

Teratogenicity: No teratogenic effects have been described for Isobutylene.

Reproductive Toxicity: No reproductive toxicity effects have been described for Isobutylene.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e., within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Acute or chronic respiratory conditions may be aggravated by overexposure to Isobutylene.

11. TOXICOLOGICAL INFORMATION (Continued)

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen, if necessary. Treat symptoms and eliminate exposure.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) are not applicable for Isobutylene.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: This gas will be dissipated rapidly in well-ventilated areas.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Any adverse effect on animals would be related to oxygen-deficient environments. No adverse effect is anticipated to occur to plant life, except for frost produced in the presence of rapidly expanding gases. See Section 11, Toxicological Information, for additional information on effects on animals.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on the effects of Isobutylene on aquatic life.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with any residual product to Airgas Inc. Do not dispose of locally.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

For Isobutylene Gas:

<u>PROPER SHIPPING NAME:</u>	Isobutylene
<u>HAZARD CLASS NUMBER and DESCRIPTION:</u>	2.1 (Flammable Gas)
<u>UN IDENTIFICATION NUMBER:</u>	UN 1055
<u>PACKING GROUP:</u>	Not Applicable
<u>DOT LABEL(S) REQUIRED:</u>	Flammable Gas
<u>NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996):</u>	115

Alternate Description:

<u>PROPER SHIPPING NAME:</u>	Petroleum gases, liquefied
<u>HAZARD CLASS NUMBER and DESCRIPTION:</u>	2.1 (Flammable Gas)
<u>UN IDENTIFICATION NUMBER:</u>	UN 1075
<u>PACKING GROUP:</u>	Not Applicable
<u>DOT LABEL(S) REQUIRED:</u>	Flammable Gas
<u>NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996):</u>	115

MARINE POLLUTANT: Isobutylene is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments.

15. REGULATORY INFORMATION

U.S. SARA REPORTING REQUIREMENTS: Isobutylene is not subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act.

U.S. SARA THRESHOLD PLANNING QUANTITY: Not applicable.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Not applicable.

CANADIAN DSL/NDSL INVENTORY STATUS: Isobutylene is on the DSL Inventory.

U.S. TSCA INVENTORY STATUS: Isobutylene is listed on the TSCA Inventory.

15. REGULATORY INFORMATION (Continued)

OTHER U.S. FEDERAL REGULATIONS: Isobutylene is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for this gas is 10,000 lb. Depending on specific operations involving the use of Isobutylene, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Under this regulation Isobutylene is not listed in Appendix A; however, any process that involves a flammable gas on-site, in one location, in quantities of 10,000 lb (4,553 kg) or greater is covered under this regulation unless it is used as a fuel.

U.S. STATE REGULATORY INFORMATION: Isobutylene is covered under specific State regulations, as denoted below:

Alaska - Designated Toxic and Hazardous Substances: Liquefied Petroleum Gas.

California - Permissible Exposure Limits for Chemical Contaminants: Liquefied Petroleum Gas.

Florida - Substance List: Isobutylene.

Illinois - Toxic Substance List: No.

Kansas - Section 302/313 List: No.

Massachusetts - Substance List: Isobutylene.

Michigan - Critical Materials Register: No.

Minnesota - List of Hazardous Substances: Liquefied Petroleum Gas.

Missouri - Employer Information/Toxic Substance List: No.

New Jersey - Right to Know Hazardous Substance List: Isobutylene.

North Dakota - List of Hazardous Chemicals, Reportable Quantities: No.

Pennsylvania - Hazardous Substance List: Isobutylene.

Rhode Island - Hazardous Substance List: Liquefied Petroleum Gas.

Texas - Hazardous Substance List: Liquefied Petroleum Gas.

West Virginia - Hazardous Substance List: Liquefied Petroleum Gas.

Wisconsin - Toxic and Hazardous Substances: Liquefied Petroleum Gas.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): Isobutylene is not on the California Proposition 65 lists.

LABELING:

DANGER:

FLAMMABLE LIQUID AND GAS UNDER PRESSURE.
CAN FORM EXPLOSIVE MIXTURES WITH AIR.
MAY CAUSE FROSTBITE.

Keep away from heat, flames, and sparks.
Store and use with adequate ventilation.
Cylinder temperature should not exceed 52°C (125°F).
Do not get liquid in eyes, on skin, or clothing.
Close valve after each use and when empty.
Use in accordance with the Material Safety Data Sheet.

FIRST AID:

IF INHALED, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

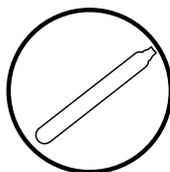
IN CASE OF FROSTBITE, obtain immediate medical attention.

DO NOT REMOVE THIS PRODUCT LABEL.

CANADIAN WHMIS SYMBOLS:

Class A: Compressed Gas

Class B1: Flammable Gas



16. OTHER INFORMATION

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.
9163 Chesapeake Drive, San Diego, CA 92123-1002
619/565-0302

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. AIRGAS, Inc. assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, AIRGAS, Inc. assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

CAS #: This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used for computer-related searching.

EXPOSURE LIMITS IN AIR:

ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV** - Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average (**TWA**), the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level (**C**). Skin absorption effects must also be considered.

OSHA - U.S. Occupational Safety and Health Administration. **PEL** - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order.

IDLH - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. **The DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (**OSHA**). NIOSH issues exposure guidelines called **Recommended Exposure Levels (RELs)**. When no exposure guidelines are established, an entry of **NE** is made for reference.

HAZARD RATINGS:

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM: Health Hazard: **0** (minimal acute or chronic exposure hazard); **1** (slight acute or chronic exposure hazard); **2** (moderate acute or significant chronic exposure hazard); **3** (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); **4** (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: **0** (minimal hazard); **1** (materials that require substantial pre-heating before burning); **2** (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); **3** (Class IB and IC flammable liquids with flash points below 38°C [100°F]); **4** (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]. Reactivity Hazard: **0** (normally stable); **1** (material that can become unstable at elevated temperatures or which can react slightly with water); **2** (materials that are unstable but do not detonate or which can react violently with water); **3** (materials that can detonate when initiated or which can react explosively with water); **4** (materials that can detonate at normal temperatures or pressures).

NATIONAL FIRE PROTECTION ASSOCIATION: Health Hazard: **0** (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury); **2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure causes death or major residual injury).

NATIONAL FIRE PROTECTION ASSOCIATION (Continued): Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association (**NFPA**). Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:

Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD₅₀** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC₅₀** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m³** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. Ecological Information: EC is the effect concentration in water.

REGULATORY INFORMATION:

This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act (**SARA**); the Canadian Domestic/Non-Domestic Substances List (**DSL/NDL**); the U.S. Toxic Substance Control Act (**TSCA**); Marine Pollutant status according to the **DOT**; the Comprehensive Environmental Response, Compensation, and Liability Act (**CERCLA** or **Superfund**); and various state regulations.

ANTIFREEZE

Initial Preparation Date: 11/10/2004

Last Revision Date: None

Effective Date: 8/1/2005

MATERIAL SAFETY DATA SHEET

PRODUCT IDENTITY: PEAK® -25° WASH

1. CHEMICAL PRODUCT & COMPANY INFORMATION

OLD WORLD INDUSTRIES, INC.
4065 COMMERCIAL AVENUE
NORTHBROOK, ILLINOIS 60062
PHONE: 847-559-2000
EMERGENCY PHONE: 1-800-424-9300 (CHEMTREC)

2. COMPOSITION / INFORMATION ON INGREDIENTS

<u>MATERIAL</u>	<u>CAS#</u>	<u>% BY WT</u>	<u>8-Hour Time Weighted Avg. (TWA)</u>
Methanol	67-56-1	<35	200 ppm (260 Mg/M ³)

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

<i>Slight odor.</i>	<i>May be fatal if swallowed.</i>	<i>Vapors can cause eye irritation.</i>
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LD50 Rat (Oral): 16,079 mg/kg (35% methanol concentration)

LD50 Rabbit (Skin): 57 g/kg (35% methanol concentration)

Carcinogeny: No

National Toxicology Program: No

International Agency for Research on Cancer: No

OSHA Regulated: Yes

HAZARD RATING SYSTEM

HMIS: HEALTH: 2 FLAMMABILITY: 2 REACTIVITY: 0 PERSONAL PROTECTION: A

KEY: 0 - Minimal 1 - Slight 2 - Moderate 3 - Serious 4 - Severe A - Safety glasses

POTENTIAL HEALTH EFFECTS

Health Hazards (Acute and Chronic):

Acute:

Acute methanol intoxication is manifested initially by signs of narcosis. This is followed by a latent period in which formic acid accumulates in the body causing metabolic acidosis. Severe abdominal, leg, and back pain occur and visual degeneration can lead to blindness.

1. Humans – Ingestion of 80 to 150 mL of methanol is usually fatal to humans (HSDB 1994). One worker died from exposure to vapor ranging from 4,000 to 13,000 ppm over 12 hours (ACGIH 1991). The concentration of 4,000 ppm is roughly equivalent to a total of 1,140 mg/kg over the 12-hour period (see end note 2). Poisoning by nonlethal doses can be described in three stages: (1) narcotic stage similar to ethanol; (2) latent period of 10-15 hours; (3) visual disturbances and central nervous system lesions (Rowe and McCollister 1981). Visual disturbances can lead to blindness due to edema of the retina and atrophy of the optic nerve head (HSDB 1994). Third-stage CNS lesions include headache, dizziness, abdominal, back, and leg pain, delirium that can lead to coma, and nausea (HSDB 1994). Formic acid production causes severe metabolic acidosis (Rowe and McCollister 1981).
2. Animals – Oral LD50 values for methanol in animals are 0.4 g/kg in the mouse, 6.2 to 13 g/kg in the rat, 14.4 g/kg in the rabbit, and 2 to 7 g/kg in the monkey (Rowe and McCollister 1981). The LD50 for dermal application to rabbits is 20 mL/kg (approximately 16 g/kg) (Rowe and McCollister 1981). Dose-response data for inhalation vary with species, dose, and duration (8,800 ppm for 8 hours to 152,800 ppm for 94 minutes). Symptoms of intoxication include incoordination, salivation, lethargy, narcosis, and death (Rowe and McCollister 1981).

Subchronic/Chronic:

Chronic exposure to methanol, either orally or by inhalation, causes headache, insomnia, gastrointestinal problems, and blindness in humans and hepatic and brain alterations in animals. EPA has derived an oral RfD (reference dose) (see end note 3) for methanol of 0.5 mg/kg/day, based on the absence of liver and brain effects in animals exposed by mouth to 500 mg/kg/day.

1. Humans – “Chronic” exposure to methanol vapors (no time or dose given) caused conjunctivitis, headache, giddiness, insomnia, gastric disturbances, and bilateral blindness (ACGIH 1991). Marked vision loss occurred in one worker exposed to 1,200 to 8,000 ppm vapor for 4 years (ACGIH 1991).
2. Animals – No effects were seen in rats given 1% (approximately 140 mg/kg/day) methanol in drinking water for 6 months (Rowe and McCollister 1981). Hepatic abnormalities (proteinic degeneration, altered RNA metabolism) occurred in rhesus monkeys given 3 to 6 g/kg for 3 to 20 weeks and in rats given 10, 100, or 500 mg/kg/day for one month (Rowe and McCollister 1981). Rabbits chronically fed methanol (no dose or time given) had increasing blood levels, brain and eye edema, and myelin thinning (HSDB 1994). Male and female rats were gavaged with 100, 500, or 2,500 mg/kg/day for 90 days (U.S. EPA 1994). Increased levels of SGPT and SAP as well as decreased brain weights were seen in both sexes at the highest dose; a no-observed-adverse effect level (NOAEL) for the study was 500 mg/kg/day. Based on

these data, the U.S. EPA (1994) calculated a chronic RfD (see end note 4) for methanol of 0.5 mg/kg/day. No toxic effects were seen in dogs exposed by inhalation to either 10,000 ppm for 3 minutes, 3x/day, for 100 days or to 450 or 500 ppm, 8 hours/day for 379 days (Rowe and McCollister 1981). Ultrastructural changes were observed in the photoreceptor cells of rabbits exposed to 46.6 ppm for 6 months (Rowe and McCollister 1981). Rowe and McCollister (1981) concluded that the effects of combined oral and inhalation exposure appear to be additive. Rats exposed by inhalation to 16.8 ppm, 4 hours/day, for 6 months and administered 0.7 mg/kg/day orally had changes in blood morphology, oxidation-reduction processes, and liver function (Rowe and McCollister 1981).

Carcinogenicity:

No information was found on the carcinogenicity of methanol in the secondary sources searched.

1. Humans – No information was found in the secondary sources searched concerning the carcinogenicity of methanol to humans.
2. Animals – No information was found in the secondary sources searched concerning the carcinogenicity of methanol to animals. The NTP has assigned a project leader for methanol and the design of the study is in progress (NTP 1994).

4. FIRST AID MEASURES

Ensure physician has access to this MSDS.

Routes of Entry: Inhalation, Skin, Ingestion

Signs and Symptoms of Exposure:

Eye Contact: May cause eye irritation.

Skin Contact: Frequent or prolonged contact may cause skin irritation experienced as burning, drying, cracking and redness.

Inhalation: May cause nose and throat irritation. High concentrations may cause acute central nervous system depression characterized by headaches, dizziness, nausea and confusion.

Skin Absorption Health Risks and Symptoms of Exposure: Harmful quantities of Methyl Alcohol may affect eyes and central nervous system.

Ingestion Health Risks and Symptoms of Exposure: May cause nausea, abdominal pain, headache, shortness of breath, visual impairment and blindness. Severe poisoning can cause coma and death.

Medical Conditions Generally Aggravated by Exposure: Ingestion of large amounts of Methyl Alcohol has been shown to damage organs including liver, kidney, pancreas, heart, lungs and brain. Although this rarely occurs, survivors of severe intoxication may suffer permanent neurological damage. Overexposure may aggravate pre-existing disorders of the eyes.

People have died as a result of drinking large amounts of methanol. Drinking smaller, non-lethal amounts of methanol adversely affects the human nervous system. Effects range from headaches to incoordination similar to that associated with drunkenness. Delayed effects such as severe abdominal, leg, and back pain can follow the inebriation effects of methanol. Loss of vision and even blindness can also occur after exposure to amounts of methanol causing inebriation. These effects are not likely to occur at levels of methanol that are normally found in the environment.

Human health effects associated with breathing or otherwise consuming smaller amounts of methanol over long periods of time are not known. Workers repeatedly exposed to methanol have experienced several adverse effects. Effects range from headaches to sleep disorders and gastrointestinal problems to optic nerve damage. Laboratory studies show that repeat exposure to large amounts of methanol in air or in drinking water cause similar adverse effects in animals.

TREATMENT

Eyes: Flush with large quantities of water for 15 minutes and seek medical attention.

Skin: Remove contaminated clothing and wash contaminated skin with large amounts of soap and water. If irritation persists, get medical attention. Launder clothing before reuse.

Inhalation: Remove to fresh air. If breathing has stopped, apply artificial respiration. If breathing is difficult, give oxygen provided a qualified operator is available. Get medical attention.

Ingestion: Notes to Physician: This product contains methanol which can cause intoxication and central nervous system depression. Methanol is metabolized to formic acid and formaldehyde. These metabolites can cause metabolic acidosis, visual disturbances and blindness. Since metabolism is required for these toxic symptoms, their onset may be delayed from 6 to 30 hours following ingestion. Ethanol competes for the same metabolic pathway and has been used to prevent methanol metabolism. Ethanol administration is indicated in symptomatic patients or at blood hemodialysis. Preexisting disorders of the following organs (or organ systems) may be aggravated by exposure to this material: skin, lung (for example, asthma-like conditions), liver, kidney, central nervous system, pancreas, heart). Exposure to this material may aggravate any preexisting condition sensitive to a decrease in available oxygen, such as chronic lung disease, coronary artery disease or anemias.

If swallowed, induce vomiting of conscious patient immediately by giving two glasses of water and pressing finger down throat. Drink a large amount of water, milk or sodium bicarbonate to dilute material in stomach. (Never give anything by mouth to an unconscious person.) Call Poison Control Center, hospital emergency room or physician immediately.

5. FIRE FIGHTING MEASURES

FIRE & EXPLOSION HAZARD DATA

Flammable Properties

Flash Point:	89° F
Method Used:	TCC

Flammability Limits - % of vapor concentration at which methanol can ignite in presence of spark.

LEL: 6.0%
UEL: 36.0%

Hazardous Combustion Products: Methanol

Extinguishing Media: Foam, dry chemical, carbon dioxide or any Class B extinguishing agent. Water may be unsuitable as an extinguishing medium but helpful in keeping adjacent containers cool

Fire Fighting Instructions: Use water spray to cool fire exposed containers.

Water may be ineffective but may be used to cool exposed containers to prevent pressure buildup and possible auto-ignition or explosion when exposed to extreme heat. If water is used, fog nozzles are preferable.

Unusual Fire and Explosion Hazards: Handle as flammable liquid. Vapors are heavier than air and may travel along the ground or may be moved by ventilation. Vapors form an explosive mixture in air between the upper and lower explosive limits which can be ignited by many sources, such as pilot lights, open flames, electrical motors and switches.

Protective Equipment For Fire Fighters: Wear NIOSH approved self-contained breathing apparatus with full face piece and protective clothing to prevent contact with skin and eyes.

6. ACCIDENTAL RELEASE MEASURES

Small Spill

Absorb liquid on vermiculite, floor absorbent or other absorbent material.

Large Spill

Eliminate all ignition sources (flares, flames including pilot lights, electrical sparks). Persons not wearing protective equipment should be excluded from area of spill until clean-up has been completed. Stop spill at source. Prevent from entering drains, sewers, streams or other bodies of water. Prevent from spreading. If runoff occurs, notify authorities as required. Pump or vacuum transfer spilled product to clean containers for recovery. Absorb unrecoverable product. Transfer contaminated absorbent, soil and other materials to containers for disposal. Prevent run-off to sewers, streams or other bodies of water. If run-off occurs, notify proper authorities as required, that a spill has occurred.

7. HANDLING AND STORAGE

Do not swallow. Store in closed containers in a cool, dry, well-ventilated area. Keep away from sparks and open flame.

Respiratory Protection: Use approved NIOSH respirator when TLV is exceeded.

Ventilation: Provide sufficient ventilation to maintain exposure below TLV.

Protective Gloves: Wear appropriate impermeable gloves.

Eye Protection: Use chemical safety glasses, goggles and face shields for eye protection.

Other Protective Clothing or Equipment: Long sleeves and apron are recommended.

Work / Hygienic Practices: Avoid prolonged or repeated skin contact.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Eye Protection: Chemical splash goggles in compliance with OSHA regulations are advised; however, OSHA regulations also permit other type safety glasses. Consult your safety representative.

Skin Protection: Wear resistant gloves (consult your safety equipment supplier). To prevent repeated or prolonged skin contact, wear impervious clothing and boots.

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see exposure guidelines), a NIOSH/MSHA approved air supplied respiratory is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your industrial hygienist). Engineering or administrative controls should be implemented to reduce exposure.

Engineering Controls: Provide sufficient mechanical (general and/or local exhaust) ventilation to maintain exposure below TLV(s).

Exposure Guidelines:

Component
Methyl Alcohol (67-56-1)
OSHA VPEL 200.000 ppm – TWA (skin)
OSHA VPEL 250.000 ppm – STEL (skin)
ACGIH TLV 200.000 ppm – TWA (skin)
ACGIH TLV 250.000 ppm – STEL (skin)

9. PHYSICAL AND CHEMICAL PROPERTIES

Boiling Range:	175° F - 179° F
Specific Gravity (Water =1):	.94 @ 20° C
Vapor Pressure (mm of Hg):	44 @ 20° C
Vapor Density (Air=1):	Heavier than air
Water Solubility:	Soluble
Appearance:	Clear blue liquid
Odor:	Mild alcohol odor
Evaporation Rate:	Greater than m-butyl acetate

10. STABILITY AND REACTIVITY

Stability: Stable

Conditions to Avoid: Ignition sources, such as heat, sparks and flames

Incompatibility (Materials to Avoid): Strong acids and strong oxidizing agents

Hazardous Decomposition Products: Burning can produce carbon monoxide and/or carbon dioxide. Carbon monoxide is highly toxic if inhaled; carbon dioxide in sufficient concentrations can act as an asphyxiant.

Hazardous Polymerization: Will not occur

11. TOXICOLOGICAL INFORMATION

Mutagenicity (The Effects On Genetic Material):

Genotoxicity:

Methanol was negative for cell transformation in Syrian hamster embryo cells (clonal assay and viral enhanced), sister chromatid exchange in vitro, and for aneuploidy and chromosome aberrations in *Neurospora crassa* (GENETOX 1992). The micronucleus test and the assay for chromosome aberrations in mammalian polychromatic erythrocytes were inconclusive (GENETOX 1992).

Developmental/Reproductive Toxicity:

No information was found on the developmental toxicity of methanol in humans. Methanol can cause adverse effects in the developing offspring in rats at doses that cause overt maternal intoxication.

1. Humans – No information was found in the secondary sources searched regarding the developmental or reproductive toxicity of methanol to humans. However, one of the breakdown products of the artificial sweetener aspartame is methanol. Increased blood methanol levels did not lead to increased formic acid levels in women receiving up to 200 mg/kg aspartame (no other details reported) and no evidence of fetal risk was detected (HSDB 1994).
2. Animals – Rats were exposed by inhalation, 7 hours/day, to 5,000 or 10,000 ppm methanol on gestation days 1-19 or to 20,000 ppm on days 7-15. Maternal intoxication (unsteadiness) occurred at the highest dose and coincided with extra or rudimentary ribs and urinary or cardiovascular defects in the fetuses (ACGIH 1991). Male rats had significantly lowered testosterone levels after inhalation exposure to 200 ppm methanol for 6 weeks; at 10,000 ppm a change in luteinizing hormone was also observed (HSDB 1994).

Neurotoxicity:

Methanol causes central nervous system depression in humans and animals as well as degenerative changes in the brain and visual system.

1. Humans – Methanol causes narcosis similar to ethanol intoxication and nonlethal doses can lead to blindness. Autopsy of individuals after lethal doses revealed edema and hyperemia of the brain and degeneration of the ganglion cells of the retina (Rowe and McCollister 1981).
2. Animals – Acute methanol intoxication in animals causes CNS depression as observed by narcosis, incoordination, lethargy, drowsiness, and prostration (Rowe and McCollister 1981).

Significant Data With Possible Relevance To Humans:

Pharmacokinetics:

1. Absorption – Methanol is readily absorbed after oral, inhalation, or dermal exposure. Oral doses in humans of 71 to 84 mg/kg resulted in blood levels of 4.7 to 7.6 mg/100 mL of blood within 3 hours (Rowe and McCollister 1981). Inhalation of 500 to 1,000 ppm methanol for 3 to 4 hours gave urine concentrations of 1 to 3 mg methanol/100 mL of urine at the end of exposure (Rowe and McCollister 1981). Based on urinary methanol levels, the rate of absorption of the chemical appears to be proportional to the concentration of vapor inhaled (HSDB 1994). The rate of dermal absorption increased for 35 minutes then decreased over the next 25 minutes (no other details given) (HSDB 1994).
2. Distribution – Methanol distributes rapidly in dogs exposed to 4,000 to 15,000 ppm for 12 hours to 5 days; the highest concentrations of the chemical were found in blood, eye fluid, bile, and urine (HSDB 1994).
3. Metabolism – Methanol is oxidized in the human liver by the enzyme alcohol dehydrogenase (Rowe and McCollister 1981). Metabolic products include formaldehyde and formic acid (HSDB 1994). The rate of metabolism for methanol (25 mg/kg/hr) is much slower than for ethanol (175 mg/kg/hr) and is independent of concentrations in the blood (HSDB 1994). Formic acid is responsible for the toxic effects of methanol (ACGIH 1991).
4. Excretion – Methanol is excreted either as parent compound in the urine or expired air, or as the formic acid metabolite in urine (Rowe and McCollister 1981; HSDB 1994). The amount of formic acid excreted varies greatly with species from 1% in rabbits to 20% in dogs; humans are intermediate (HSDB 1994). In humans, the half-life of methanol elimination in expired air after oral or dermal exposure is 1.5 hours (HSDB 1994).

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL FATE

Methanol evaporates when exposed to air. It dissolves completely when mixed with water. Most direct releases of methanol to the environment are to air. Methanol also evaporates from water and soil exposed to air. Once in air, it breaks down to other chemicals. Microorganisms that live in water and in soil can also break down methanol. Because it is a liquid that does not bind well to soil, methanol that makes it way into the ground can move through the ground and enter groundwater. Plants and animals are not likely to store methanol.

Methanol by itself is not likely to cause environmental harm at levels normally found in the environment. Methanol can contribute to the formation of photochemical smog when it reacts with other volatile organic carbon substances in air.

Movement & Partitioning:

The miscibility of methanol in water and a low KOC (9) indicate that the chemical will be highly mobile in soil (HSDB 1994). Volatilization half-lives from a model river and an environmental pond were estimated at 4.8 days and 51.7 days, respectively (HSDB 1994). Methanol can be removed from the atmosphere in rain water (HSDB 1994).

Degradation & Transformation:

1. Air – Once in the atmosphere, methanol exists in the vapor phase with a half life of 17.8 days (HSDB 1994). The chemical reacts with photochemically produced hydroxyl radicals to produce formaldehyde (HSDB 1994). Methanol can also react with nitrogen dioxide in polluted air to form methyl nitrite (HSDB 1994).
2. Soil – Biodegradation is the major route of removal of methanol from soils. Several species of *Methylobacterium* and *Methylomonas* isolated from soils are capable of utilizing methanol as a sole carbon source (CHEMFATE 1994).
3. Water – Most methanol is removed from water by biodegradation. The degradation products of methane and carbon dioxide were detected from aqueous cultures of mixed bacteria isolated from sewage sludge (CHEMFATE 1994). Aerobic, Gram-negative bacteria (65 strains) isolated from seawater, sand, mud, and weeks of marine origin utilized methanol as a sole carbon source (CHEMFATE 1994). Aquatic hydrolysis, oxidation, and photolysis are not significant fate processes for methanol (HSDB 1994).
4. Biota – Bioaccumulation of methanol in aquatic organisms is not expected to be significant based on an estimated bioconcentration factor of 0.2 (HSDB 1994).

Ecotoxicology:

1. Toxicity to Aquatic Organisms – Methanol has low acute toxicity to aquatic organisms; lethal concentrations are much greater than 100 mg/L. Ninety-six hour LC50 values for fish are 28,100 mg/L for *Pimephales promelas* (fathead minnow), 20,100 mg/L for *Oncorhynchus mykiss* (rainbow trout), and >28,000 mg/L for *Alburnus alburnus* (bleak) (AQUIRE 1994). Forty-eight hour LC50 values for *Cyprinus carpio* (common carp) and *Carassius auratus* (goldfish) are 28,000 mg/L and 1,700 mg/L, respectively (AWQUIRE 1994). Growth inhibition occurred for 4 strains of *Anabaena* (blue-green algae) over a range of EC50s of 2.57%-3.13% for 10-14 days (AQUIRE 1994). The LC50 for *Artemia salina* (brine shrimp) is >10,000 mg/L in 24 hours and that for *Culex restuans* (mosquito) is 20,000 mg/L in 18 hours (AQUIRE 1994).
2. Toxicity to Terrestrial Organisms – No information was found in the secondary sources searched regarding the toxicity of methanol to terrestrial organisms. However, based on the range of oral LD50s, 0.4 to 14.2 g/kg, for monkeys, rats, mice, and rabbits (Rowe and McCollister 1981), it is unlikely that methanol would be toxic to terrestrial animals at environmental levels.
3. Abiotic Effects – Methanol reacts with nitrogen dioxide in polluted atmospheres to produce methyl nitrite (HSDB 1994). According to the definition provided in the Federal Register (1992), methanol is a volatile organic compound (VOC) substance. As a VOC, methanol can contribute to the formation of photochemical smog in the presence of other VOCs.

13. DISPOSAL CONSIDERATIONS

Waste Disposal Method: Dispose in accordance with federal, state and local regulations.

14. TRANSPORT INFORMATION

(U.S. D.O.T.) – U. S. Department of Transportation

Proper Shipping Name: Consumer Commodity ORM-D
Per 49 CFR Part 173.10 (PG III, inner packaging no more than 5.0 L)

(IATA) International Air Dangerous Good Regulations

Proper Shipping Name: Flammable Liquid, n.o.s. (Methanol)
ID #: UN 1993
Class: 3
Hazard Label: Flammable Liquid
PG: III
Ltd. Qty. Packaging Instruction: Y309 (Max qty. per package 10L)
Special Provision: A3

(IMDG) International Maritime Dangerous Goods

In Non-Bulk Quantities with inner packaging no more than 5.0L

Proper Shipping Name: Dangerous Goods in Limited Class 3 (Windshield Wash Containing Methanol)
Packages or pallets must be marked “Dangerous Goods in Limited Quantities of Class 3”
Outer package cannot weigh more than 30 kg.

15. REGULATORY INFORMATION

THIS PRODUCT CONTAINS COMPONENT(S) CITED ON THE FOLLOWING REGULATIONS:

<u>CHEMICAL NAME</u>	<u>CAS NUMBER</u>
Methanol	67-56-1

U.S. Federal Regulations

TSCA (Toxic Substances Control Act) Status – TSCA (UNITED STATES)

The intentional ingredients of this product are listed.

CERCLA RQ – 40 CFR 302.4(a)

<u>Component</u>	<u>RQ (lbs)</u>
Methyl Alcohol	5,000

SARA 302 Components – 40 CFR 355 Appendix A

None

Section 311/312 Hazard Class – 40 CFR 370.2

Immediate (X) Delayed (X) Fire (X) Reactive () Sudden Release of Pressure ()

SARA 313 Components – 40 CFR 372.65

<u>Section 313 Component(s)</u>	<u>CAS Number</u>	<u>%</u>
Methanol	67-56-1	35

International Regulations

Inventory Status – DSL (CANADA)

The intentional ingredients of this product are listed.

WHMIS Information: B2, D1A

ECL (SOUTH KOREA)

The intentional ingredients of this product are listed.

EINECS (EUROPE)

The intentional ingredients of this product are listed.

ENCS (JAPAN)

The intentional ingredients of this product are listed.

State and Local Regulations – California Proposition 65

None

New Jersey RTK (Right-to-Know) Label Information

Methyl Alcohol 67-56-1

Pennsylvania RTK (Right-to-Know) Label Information

Methanol 67-56-1

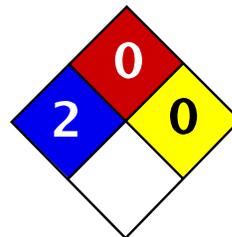
Atmospheric Standards: The Clean Air Act Amendments of 1990 list methanol as a hazardous air pollutant.

16. OTHER INFORMATION

Contact: Tom Cholke

Phone: (847) 559-2225

Old World Industries, Inc. makes no warranty, representation or guarantee as to the accuracy, sufficiency or completeness of the material set forth herein. It is the user's responsibility to determine the safety, toxicity and suitability of his own use, handling and disposal of this product. Since actual use by others is beyond our control, no warranty, expressed or implied, is made by Old World Industries, Inc. as to the effects of such use, the results to be obtained or the safety and toxicity of this product, nor does Old World Industries, Inc. assume liability arising out of the use by others of this product referred to herein. The data in this MSDS relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.



Health	2
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet Bentonite MSDS

Section 1: Chemical Product and Company Identification

Product Name: Bentonite

Catalog Codes: SLB1441, SLB2935, SLB4435

CAS#: 1302-78-9

RTECS: CT9450000

TSCA: TSCA 8(b) inventory: Bentonite

CI#: Not applicable.

Synonym: Montmorillonite;

Chemical Name: Not available.

Chemical Formula:

(Al,Fe1.67Mg.33)Si10(OH)2Na(+)Ca(++)/2.33

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Bentonite	1302-78-9	100

Toxicological Data on Ingredients: Bentonite LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of eye contact (irritant), of inhalation. Slightly hazardous in case of skin contact (irritant), of ingestion.

Potential Chronic Health Effects:

Hazardous in case of inhalation.

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

The substance is toxic to lungs.

Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Do not breathe dust. Avoid contact with eyes. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:

Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 10 from ACGIH (TLV) [United States]

Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Odorless.

Taste: Not available.

Molecular Weight: Not available.

Color: Beige. (Light.)

pH (1% soln/water): Not available.

Boiling Point: Not available.

Melting Point: Decomposes.

Critical Temperature: Not available.

Specific Gravity: 2.5 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:

Very slightly soluble in cold water, hot water.
Insoluble in methanol, diethyl ether, n-octanol, acetone.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Not available.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Eye contact. Inhalation.

Toxicity to Animals:

LD50: Not available.

LC50: Not available.

Chronic Effects on Humans: Causes damage to the following organs: lungs.

Other Toxic Effects on Humans:

Hazardous in case of inhalation.

Slightly hazardous in case of skin contact (irritant), of ingestion.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations: TSCA 8(b) inventory: Bentonite

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC): R36- Irritating to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves.

Lab coat.

Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.

Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:14 PM

Last Updated: 11/06/2008 12:00 PM

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Material Safety Data Sheet

Section 1: PRODUCT AND COMPANY INFORMATION

Product Name(s): Lafarge Portland Cement (cement)

Product Identifiers: Cement, Portland Cement, Hydraulic Cement, Oil Well Cement, Trinity[®] White Cement, Antique White Cement, Portland Cement Type I, IA, IE, II, I/II, IIA, II L.A., III, IIIA, IV, IVA, V, VA, 10, 20, 30, 40, 50, GU, MS, MH, HE, LH, HS, OWH, OWG Cement, OW Class G HSR

Manufacturer:
Lafarge North America Inc.
12950 Worldgate Drive, Suite 500
Herndon, VA 20170

Information Telephone Number:
703-480-3600 (9am to 5pm EST)

Emergency Telephone Number:
1-800-451-8346 (3E Hotline)

Product Use: Cement is used as a binder in concrete and mortars that are widely used in construction. Cement is distributed in bags, totes and bulk shipment.

Note: This MSDS covers many types of Portland cement. Individual composition of hazardous constituents will vary between types of Portland cement.

Section 2: COMPOSITION/INFORMATION ON INGREDIENTS

Component	Percent (By Weight)	CAS Number	OSHA PEL -TWA (mg/m ³)	ACGIH TLV-TWA (mg/m ³)	LD ₅₀ (mouse, intraperitoneal)	LC ₅₀
Portland Cement*	100	65997-15-1	15 (T); 5 (R)	10 (R)	NA	NA
Calcium Sulfate*	2-10	13397-24-5	15 (T); 5 (R)	10 (T)	NA	NA
Calcium Carbonate*	0-5	1317-65-3	15 (T); 5 (R)	10 (T)	NA	NA
Calcium Oxide	0-5	1305-78-8	5 (T)	2 (T)	3059 mg/kg	NA
Magnesium Oxide	0-4	1309-48-4	15 (T)	10 (T)	NA	NA
Crystalline Silica	0-0.2	14808-60-7	[(10) / (%SiO ₂ +2)] (R); [(30) / (%SiO ₂ +2)] (T)	0.025 (R)	NA	NA

Note: Exposure limits for components noted with an * contain no asbestos and <1% crystalline silica

Cement is made from materials mined from the earth and is processed using energy provided by fuels. Trace amounts of chemicals may be detected during chemical analysis. For example, cement may contain trace amounts of calcium oxide (also known as free lime or quick lime), free magnesium oxide, potassium and sodium sulfate compounds, chromium compounds, nickel compounds, and other trace compounds.

Section 3: HAZARD IDENTIFICATION

	WARNING	 Respiratory Protection  Waterproof Gloves  Eye Protection  Waterproof Boots
	<p>Corrosive - Causes severe burns. Toxic - Harmful by inhalation. (Contains crystalline silica)</p> <p>Use proper engineering controls, work practices, and personal protective equipment to prevent exposure to wet or dry product.</p> <p>Read MSDS for details.</p>	

Section 3: HAZARD IDENTIFICATION (continued)

Emergency Overview: Cement is a solid, grey, off white, or white odorless powder. It is not combustible or explosive. A single, short-term exposure to the dry powder presents little or no hazard. Exposure of sufficient duration to wet cement, or to dry cement on moist areas of the body, can cause serious, potentially irreversible tissue (skin, eye, respiratory tract) damage due to chemical (caustic) burns, including third degree burns.

Potential Health Effects:

Eye Contact: Airborne dust may cause immediate or delayed irritation or inflammation. Eye contact with large amounts of dry powder or with wet cement can cause moderate eye irritation, chemical burns and blindness. Eye exposures require immediate first aid and medical attention to prevent significant damage to the eye.

Skin Contact: Cement may cause dry skin, discomfort, irritation, severe burns, and dermatitis.

Burns: Exposure of sufficient duration to wet cement, or to dry cement on moist areas of the body, can cause serious, potentially irreversible damage to skin, eye, respiratory and digestive tracts due to chemical (caustic) burns, including third degree burns. A skin exposure may be hazardous even if there is no pain or discomfort.

Dermatitis: Cement is capable of causing dermatitis by irritation and allergy. Skin affected by dermatitis may include symptoms such as, redness, itching, rash, scaling, and cracking.

Irritant dermatitis is caused by the physical properties of cement including alkalinity and abrasion.

Allergic contact dermatitis is caused by sensitization to hexavalent chromium (chromate) present in cement. The reaction can range from a mild rash to severe skin ulcers. Persons already sensitized may react to the first contact with cement. Others may develop allergic dermatitis after years of repeated contact with cement.

Inhalation (acute): Breathing dust may cause nose, throat or lung irritation, including choking, depending on the degree of exposure. Inhalation of high levels of dust can cause chemical burns to the nose, throat and lungs.

Inhalation (chronic): Risk of injury depends on duration and level of exposure.

Silicosis: This product contains crystalline silica. Prolonged or repeated inhalation of respirable crystalline silica from this product can cause silicosis, a seriously disabling and fatal lung disease. See Note to Physicians in Section 4 for further information.

Carcinogenicity: Cement is not listed as a carcinogen by IARC or NTP; however, cement contains trace amounts of crystalline silica and hexavalent chromium which are classified by IARC and NTP as known human carcinogens.

Autoimmune Disease: Some studies show that exposure to respirable crystalline silica (without silicosis) or that the disease silicosis may be associated with the increased incidence of several autoimmune disorders such as scleroderma (thickening of the skin), systemic lupus erythematosus, rheumatoid arthritis and diseases affecting the kidneys.

Tuberculosis: Silicosis increases the risk of tuberculosis.

Renal Disease: Some studies show an increased incidence of chronic kidney disease and end-stage renal disease in workers exposed to respirable crystalline silica.

Section 3: HAZARD IDENTIFICATION (continued)

Ingestion: Do not ingest cement. Although ingestion of small quantities of cement is not known to be harmful, large quantities can cause chemical burns in the mouth, throat, stomach, and digestive tract.

Medical Conditions Aggravated by Exposure: Individuals with lung disease (e.g. bronchitis, emphysema, COPD, pulmonary disease) or sensitivity to hexavalent chromium can be aggravated by exposure.

Section 4: FIRST AID MEASURES

Eye Contact: Rinse eyes thoroughly with water for at least 15 minutes, including under lids, to remove all particles. Seek medical attention for abrasions and burns.

Skin Contact: Wash with cool water and a pH neutral soap or a mild skin detergent. Seek medical attention for rash, burns, irritation, dermatitis, and prolonged unprotected exposures to wet cement, cement mixtures or liquids from wet cement.

Inhalation: Move person to fresh air. Seek medical attention for discomfort or if coughing or other symptoms do not subside.

Ingestion: Do not induce vomiting. If conscious, have person drink plenty of water. Seek medical attention or contact poison control center immediately.

Note to Physician: The three types of silicosis include:

- Simple chronic silicosis – which results from long-term exposure (more than 20 years) to low amounts of respirable crystalline silica. Nodules of chronic inflammation and scarring provoked by the respirable crystalline silica form in the lungs and chest lymph nodes. This disease may feature breathlessness and may resemble chronic obstructive pulmonary disease (COPD).
- Accelerated silicosis – occurs after exposure to larger amounts of respirable crystalline silica over a shorter period of time (5-15 years). Inflammation, scarring, and symptoms progress faster in accelerated silicosis than in simple silicosis.
- Acute silicosis – results from short-term exposure to very large amounts of respirable crystalline silica. The lungs become very inflamed and may fill with fluid, causing severe shortness of breath and low blood oxygen levels.

Progressive massive fibrosis may occur in simple or accelerated silicosis, but is more common in the accelerated form. Progressive massive fibrosis results from severe scarring and leads to the destruction of normal lung structures.

Section 5: FIREFIGHTING MEASURES

Flashpoint & Method:	Non-combustible	Firefighting Equipment:	Cement poses no fire-related hazard. A SCBA is recommended to limit exposures to combustion products when fighting any fire.
General Hazard:	Avoid breathing dust. Wet cement is caustic.		
Extinguishing Media:	Use extinguishing media appropriate for surrounding fire.	Combustion Products:	None.

Section 6: ACCIDENTAL RELEASE MEASURES

General: Place spilled material into a container. Avoid actions that cause the cement to become airborne. Avoid inhalation of cement and contact with skin. Wear appropriate protective equipment as described in Section 8. Scrape wet cement and place in container. Allow material to dry or solidify before disposal. Do not wash cement down sewage and drainage systems or into bodies of water (e.g. streams).

Waste Disposal Method: Dispose of cement according to Federal, State, Provincial and Local regulations.

Section 7: HANDLING AND STORAGE

General: Keep bulk and bagged cement dry until used. Stack bagged material in a secure manner to prevent falling. Bagged cement is heavy and poses risks such as sprains and strains to the back, arms, shoulders and legs during lifting and mixing. Handle with care and use appropriate control measures.

Engulfment hazard. To prevent burial or suffocation, do not enter a confined space, such as a silo, bin, bulk truck, or other storage container or vessel that stores or contains cement. Cement can buildup or adhere to the walls of a confined space. The cement can release, collapse or fall unexpectedly.

Properly ground all pneumatic conveyance systems. The potential exists for static build-up and static discharge when moving cement powders through a plastic, non-conductive, or non-grounded pneumatic conveyance system. The static discharge may result in damage to equipment and injury to workers.

Usage: Cutting, crushing or grinding hardened cement, concrete or other crystalline silica-bearing materials will release respirable crystalline silica. Use all appropriate measures of dust control or suppression, and Personal Protective Equipment (PPE) described in Section 8 below.

Housekeeping: Avoid actions that cause the cement to become airborne during clean-up such as dry sweeping or using compressed air. Use HEPA vacuum or thoroughly wet with water to clean-up dust. Use PPE described in Section 8 below.

Storage Temperature: Unlimited. **Storage Pressure:** Unlimited.

Clothing: Promptly remove and launder clothing that is dusty or wet with cement. Thoroughly wash skin after exposure to dust or wet cement.

Section 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls: Use local exhaust or general dilution ventilation or other suppression methods to maintain dust levels below exposure limits.

Personal Protective Equipment (PPE):

Respiratory Protection: Under ordinary conditions no respiratory protection is required. Wear a NIOSH approved respirator that is properly fitted and is in good condition when exposed to dust above exposure limits.

Eye Protection: Wear ANSI approved glasses or safety goggles when handling dust or wet cement to prevent contact with eyes. Wearing contact lenses when using cement, under dusty conditions, is not recommended.

Section 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION (continued)

Skin Protection: Wear gloves, boot covers and protective clothing impervious to water to prevent skin contact. Do not rely on barrier creams, in place of impervious gloves. Remove clothing and protective equipment that becomes saturated with wet cement and immediately wash exposed areas.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid (powder).	Evaporation Rate:	NA.
Appearance:	Gray, off white or white powder.	pH (in water):	12 – 13
Odor:	None.	Boiling Point:	>1000° C
Vapor Pressure:	NA.	Freezing Point:	None, solid.
Vapor Density:	NA.	Viscosity:	None, solid.
Specific Gravity:	3.15	Solubility in Water:	Slightly (0.1 - 1.0%)

Section 10: STABILITY AND REACTIVITY

Stability: Stable. Keep dry until use. Avoid contact with incompatible materials.

Incompatibility: Wet cement is alkaline and is incompatible with acids, ammonium salts and aluminum metal. Cement dissolves in hydrofluoric acid, producing corrosive silicon tetrafluoride gas. Cement reacts with water to form silicates and calcium hydroxide. Silicates react with powerful oxidizers such as fluorine, boron trifluoride, chlorine trifluoride, manganese trifluoride, and oxygen difluoride.

Hazardous Polymerization: None. **Hazardous Decomposition:** None.

Section 11 and 12: TOXICOLOGICAL AND ECOLOGICAL INFORMATION

For questions regarding toxicological and ecological information refer to contact information in Section 1.

Section 13: DISPOSAL CONSIDERATIONS

Dispose of waste and containers in compliance with applicable Federal, State, Provincial and Local regulations.

Section 14: TRANSPORT INFORMATION

This product is not classified as a Hazardous Material under U.S. DOT or Canadian TDG regulations.

Section 15: REGULATORY INFORMATION

OSHA/MSHA Hazard Communication: This product is considered by OSHA/MSHA to be a hazardous chemical and should be included in the employer's hazard communication program.

CERCLA/SUPERFUND: This product is not listed as a CERCLA hazardous substance.

EPCRA SARA Title III: This product has been reviewed according to the EPA Hazard Categories promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 and is considered a hazardous chemical and a delayed health hazard.

EPCRA SARA Section 313: This product contains none of the substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Section 15: REGULATORY INFORMATION (continued)

- RCRA:** If discarded in its purchased form, this product would not be a hazardous waste either by listing or characteristic. However, under RCRA, it is the responsibility of the product user to determine at the time of disposal, whether a material containing the product or derived from the product should be classified as a hazardous waste.
- TSCA:** Portland cement and crystalline silica are exempt from reporting under the inventory update rule.
- California Proposition 65:** Crystalline silica (airborne particulates of respirable size) and Chromium (hexavalent compounds) are substances known by the State of California to cause cancer.
- WHMIS/DSL:** Products containing crystalline silica and calcium carbonate are classified as D2A, E and are subject to WHMIS requirements.



Section 16: OTHER INFORMATION

Abbreviations:

>	Greater than	NA	Not Applicable
ACGIH	American Conference of Governmental Industrial Hygienists	NFPA	National Fire Protection Association
CAS No	Chemical Abstract Service number	NIOSH	National Institute for Occupational Safety and Health
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act	NTP	National Toxicology Program
		OSHA	Occupational Safety and Health Administration
CFR	Code for Federal Regulations	PEL	Permissible Exposure Limit
CL	Ceiling Limit	pH	Negative log of hydrogen ion
DOT	U.S. Department of Transportation	PPE	Personal Protective Equipment
EST	Eastern Standard Time	R	Respirable Particulate
HEPA	High-Efficiency Particulate Air	RCRA	Resource Conservation and Recovery Act
HMIS	Hazardous Materials Identification System	SARA	Superfund Amendments and Reauthorization Act
IARC	International Agency for Research on Cancer	T	Total Particulate
		TDG	Transportation of Dangerous Goods
LC ₅₀	Lethal Concentration	TLV	Threshold Limit Value
LD ₅₀	Lethal Dose	TWA	Time Weighted Average (8 hour)
mg/m ³	Milligrams per cubic meter	WHMIS	Workplace Hazardous Materials Information System
MSHA	Mine Safety and Health Administration		

This MSDS (Sections 1-16) was revised on March 1, 2008.

An electronic version of this MSDS is available at: www.lafarge-na.com under the Products section.

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NO WARRANTY IS MADE, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OTHERWISE.

MEDUSA CORPORATION -- MEDUSA GREY TYPE 1, 1A, 11, V, HIGH EARLY MEDUSA
WHITE, MEDU -- -

===== Product Identification =====

Product ID:MEDUSA GREY TYPE 1, 1A, 11, V, HIGH EARLY MEDUSA WHITE, MEDU
MSDS Date:06/19/1997
FSC:NIIN:Submitter:D DG
Status Code:A
MSDS Number: CKNYH
=== Responsible Party ===
Company Name:MEDUSA CORPORATION
Box:5668
City:CLEVELAND
State:OH
ZIP:44101
Country:US
Info Phone Num:216-371-4000
Emergency Phone Num:216-371-4000
CAGE:TO771

=== Contractor Identification ===

Company Name:MEDUSA CORPORATION
Box:5668
City:CLEVELAND
State:OH
ZIP:44101
Country:US
Phone:216-371-4000
CAGE:TO771
Company Name:WALTER RB AFFIL OF SAX ARTS AND CRAFTS INC
Address:2405 S CALHOUN RD
Box:51710
City:NEW BERLIN
State:WI
ZIP:53151-0710
Country:US
Phone:414-784-6880
Contract Num:MDA414-00-P-3700
CAGE:ORKV4

===== Composition/Information on Ingredients =====

Ingred Name:3CAO.SIO2
CAS:12168-85-3

Ingred Name:2CAO.SIO2
CAS:10034-77-2

Ingred Name:3CAO.AL2O3
CAS:12042-78-3

Ingred Name:4CAO.AL2O3.FE2O3
CAS:12068-35-8

Ingred Name:CASO4.XH2O
CAS:13397-24-5
RTECS #:MG2360000
OSHA PEL:15 MG/M3

Ingred Name:SMALL AMOUNTS OF CAO, MGO, K2SO4, NA2SO4 MAY ALSO BE PRESENT.

===== Hazards Identification =====

Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO

Health Hazards Acute and Chronic:ACUTE: WET CEMENT, ESPECIALLY AS AN INGREDIENT IN PLASTIC UNHARDENED CONCRETE, MORTAR OR SLURRIES, CAN DRY THE SKIN AND CAUSE CAUSTIC BURNS. DIRECT CONTACT WITH EYES CAN CAUSE IRRITATION. INHALATION CAN IRRITATE THE UPPER RESPIRATORY SYSTEM. CHRONIC: CEMENT DUST CAN CAUSE INFLAMMATION OF THE LINING TISSUE OF THE INTERIOR OF THE NOSE AND INFLAMMATION OF THE CORNEA. HYPERSENSITIVE INDIVIDUALS MAY DEVELOP AN ALLERGIC DERMATITIS.(CEMENT MAY CONTAIN TRACE (LESS THAN 0.05%) AMOUNTS OF CHROMIUM SALTS OR COMPOUNDS INCLUDING HEXAVALENT CHROMIUM, OR OTHER METALS FOUND TO BE HAZARDOUS OR TOXIC IN SOME CHEMICAL FORMS.)

Effects of Overexposure:CUTE: WET CEMENT, ESPECIALLY AS AN INGREDIENT IN PLASTIC UNHARDENED CONCRETE, MORTAR AND SLURRIES, CAN DRY THE SKIN AND CAUSE CAUSTIC BURNS. DIRECT CONTACT WITH EYES CAN CAUSE IRRITATION. INHALATION CAN IRRITATE THE UPPER RESPIRATORY SYSTEM. CHRONIC: CEMENT DUST CAN CAUSE INFLAMMATION OF THE LINING TISSUE OF THE INTERIOR OF THE NOSE AND INFLAMMATION OF THE CORNEA. HYPERSENSITIVE INDIVIDUALS MAY DEVELOP AN ALLERGIC DERMATITIS.(CEMENT MAY CONTAIN TRACE (LESS THAN 0.05%) AMOUNTS OF CHROMIUM SALTS OR COMPOUNDS INCLUDING HEXAVALENT CHROMIUM, OR OTHER METALS FOUND TO BE HAZARDOUS OR TOXIC IN SOME CHEMICAL FORMS.)

===== First Aid Measures =====

First Aid:IRRIGATE THE EYES IMMEDIATELY AND REPEATEDLY WITH WATER AND GET PROMPT MEDICAL ATTENTION. WASH EXPOSED SKIN AREAS WITH SOAP AND WATER. APPLY STERILE DRESSINGS. IF INGESTED, CONSULT A PHYSICIAN IMMEDIATELY. DRINK WATER.

===== Fire Fighting Measures =====

Flash Point:NONCOMBUSTIBLE

Extinguishing Media:PORTLAND CEMENTS ARE NONCOMBUSTIBLE AND NOT EXPLOSIVE.

===== Accidental Release Measures =====

Spill Release Procedures:USE DRY CLEANUP METHODS THAT DO NOT DISPERSE THE DUST INTO THE AIR. AVOID BREATHING THE DUST. EMERGENCY PROCEDURES ARE NOT REQUIRED.

===== Exposure Controls/Personal Protection =====

Respiratory Protection:IN DUSTY ENVIRONMENTS, THE USE OF A MSHA/NIOSH APPROVED RESPIRATOR IS RECOMMENDED.

Ventilation:LOCAL EXHAUST CAN BE USED TO CONTROL AIRBORNE DUST LEVELS.

Protective Gloves:IMPERVIOUS, ABRASION- AND ALKALI-RESISTANT GLOVES

Eye Protection:TIGHT FITTING GOGGLES

Other Protective Equipment:USE BARRIER CREAM, IMPERVIOUS, ABRASION- & ALKALINE-RESISTANT GLOVES, BOOTS, AND PROTECTIVE CLOTHING TO PROTECT THE SKIN FROM PROLONGED CONTACT WITH WET CEMENT IN PLASTIC CONCRETE, MORTAR, OR SLURRIES.

Work Hygienic Practices:IMMEDIATELY AFTER WORKING WITH CEMENT OR CEMENT-CONTAINING MATERIALS, WORKERS SHOULD SHOWER WITH SOAP AND WATER. PRECAUTIONS MUST BE TAKEN. CEMENT BURNS WITH LITTLE

WARNING-LITTLE HEAT IS SENSED.
Supplemental Safety and Health
SAX P/N: 651-455.

===== Physical/Chemical Properties =====

HCC:N1
Spec Gravity:3.15
Solubility in Water:SLIGHT (0.1-1.0)
Appearance and Odor:GRAY OR WHITE POWDER; NO ODOR

===== Stability and Reactivity Data =====

Stability Indicator/Materials to Avoid:YES
ALUMINUM POWDER AND OTHER ALKALI AND ALKALINE EARTH ELEMENTS WILL REACT
IN WET MORTAR OR CONCRETE, LIBERATING HYDROGEN GAS.
Stability Condition to Avoid:KEEP DRY UNTIL USED.
Hazardous Decomposition Products:NONE

===== Disposal Considerations =====

Waste Disposal Methods:SMALL AMOUNTS OF MATERIAL CAN BE DISPOSED OF AS
COMMON WASTE OR RETURNED TO THE CONTAINER FOR LATER USE IF IT IS
NOT CONTAMINATED. LARGE VOLUMES MAY REQUIRE SPECIAL HANDLING.

===== MSDS Transport Information =====

Transport Information:D.O.T.: NON-HAZARDOUS.

===== Regulatory Information =====

SARA Title III Information:THIS PRODUCT DOES NOT CONTAIN AN AMOUNT OF
ANY CHEMICAL REQUIRED TO BE REPORTED UNDER SARA 313.
Federal Regulatory Information:ALL INGREDIENTS IN THIS PRODUCT ARE ON
THE TSCA LIST.

===== Other Information =====

Disclaimer (provided with this information by the compiling agencies):
This information is formulated for use by elements of the Department
of Defense. The United States of America in no manner whatsoever,
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assume responsibility for the suitability of this information to their
particular situation.



CAMEO Chemicals



Chemical Datasheet

PORTLAND CEMENT

Chemical Identifiers

UN/NA Number	CAS Number	CHRIS Code	DOT Hazard Label
none	65997-15-1	none	data unavailable

NFPA 704: data unavailable

General Description

A gray to white, odorless powder. A finely ground (powdered) mixture of mainly $3\text{CaO}\cdot\text{SiO}_2$ (tricalcium silicate), $2\text{CaO}\cdot\text{SiO}_2$ (dicalcium silicate), $\text{CaO}\cdot\text{Al}_2\text{O}_3$ (tricalcium aluminate), $4\text{CaO}\cdot\text{Al}_2\text{O}_3\cdot\text{Fe}_2\text{O}_3$ (tetracalcium aluminoferrite) and $\text{CaSO}_4\cdot 2\text{H}_2\text{O}$ (calcium sulfate dihydrate).

Hazards

Reactivity Alerts

none

Air & Water Reactions

No rapid reaction with air Reaction with water with evolution of heat

Fire Hazard

No information available.

Health Hazard

Exposure Routes: inhalation, ingestion, skin and/or eye contact

Symptoms: Irritation eyes, skin, nose; cough, expectoration; exertional dyspnea (breathing difficulty), wheezing, chronic bronchitis; dermatitis

Target Organs: Eyes, skin, respiratory system (NIOSH, 2003)

Reactivity Profile

Sets in an exothermic reaction to a solid of low strength within hours after mixing with water. Continuing slower exothermic reactions harden the product to a tough gray stony mass. Incompatible with acids, acid chlorides, and acid anhydrides when set. Incompatible with ammonium salts and aluminum metal when wet and unset.

Belongs to the Following Reactive Group(s)

- Salts, Basic Inorganic/Organic
- Inorganic Compounds/Neither Reducing nor Oxidizing

Response Recommendations

Firefighting

No information available.

Non-Fire Response

No information available.

Protective Clothing

Skin: Wear appropriate personal protective clothing to prevent skin contact.

Eyes: Wear appropriate eye protection to prevent eye contact.

Wash skin: The worker should immediately wash the skin when it becomes contaminated.

Remove: Work clothing that becomes wet or significantly contaminated should be removed and replaced.

Change: No recommendation is made specifying the need for the worker to change clothing after the work shift. (NIOSH, 2003)

First Aid

Eye: If this chemical contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

Skin: If this chemical contacts the skin, promptly wash the contaminated skin with soap and water. If this chemical penetrates the clothing, promptly remove the clothing and wash the skin with soap and water. Get medical attention promptly.

Breathing: If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. Other measures are usually unnecessary.

Swallow: If this chemical has been swallowed, get medical attention immediately. (NIOSH, 2003)

Physical Properties

Molecular Formula: data unavailable

Flash Point: data unavailable

Lower Explosive Limit: data unavailable

Upper Explosive Limit: data unavailable

Autoignition Temperature: data unavailable

Melting Point: data unavailable

Vapor Pressure: 0.0 mm Hg (approx) (NIOSH, 2003)

Vapor Density: data unavailable

Specific Gravity: data unavailable

Boiling Point: data unavailable

Molecular Weight: data unavailable

Water Solubility: Insoluble (NIOSH, 2003)

AEGL: data unavailable

ERPG: data unavailable

TEEL: data unavailable

IDLH: 5000.0 mg/m³ (NIOSH, 2003)

Regulatory Information

Regulatory Names: none

CAA RMP: Not a regulated chemical.

CERCLA: Not a regulated chemical.

EHS (EPCRA 302): Not a regulated chemical.

TRI (EPCRA 313): Not a regulated chemical.

RCRA Chemical Code: none

Alternate Chemical Names

- CEMENT
- HYDRAULIC CEMENT
- PORTLAND CEMENT SILICATE



MATERIAL SAFETY DATA SHEET

St. Marys Silica Fume Cement

Date Prepared: November 2001 (**Revised: September 2007**)

SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Chemical Name and Synonyms: Silica Fume Cement and Hydraulic Cement CAS #65997-15-1
CAS #7631-86-9

Chemical Family: Calcium Compounds

Product names: St. Marys Silica Fume Cement / Type GUB-8.5SF / Type 10SF

Note:

As this MSDS covers all St. Marys Silica Fume cement, composition of individual products may vary with regard to hazardous constituents.

WHMIS classification D2A, E

Manufacturer: St. Marys Cement
55 Industrial Street
Toronto, ON M4G 3W9

Informational Telephone Number: 1-800-268-6148 (Canada)
1-800-462-9157 (Ext.568) (U.S.)

Emergency Telephone Number: 1-613-996-6666 CANUTEC (Call Collect or *666 Cellular) (Canada)
1-800-462-9157 (U.S.)

General Information:

Silica Fume Cement is the binding ingredient in some special concrete mixes. Concrete is widely used as a building material for structures and pavement.

Composition/Information on Ingredients:

Product: Silica Fume Cement CAS #65997-15-1 and CAS #7631-86-9

Major ingredients are:

Component	CAS Number	Formula	Percent
Tricalcium Silicate	12168-85-3	3CaOSiO ₂	20-80
Dicalcium Silicate	10034-77-2	2CaOSiO ₂	0-50
Tetracalcium Aluminoferrite	12068-35-8	4CaOAl ₂ O ₃ Fe ₂ O ₃	0-20
Tri-Calcium Aluminate	12042-78-3	3CaOAl ₂ O ₃	0-15
Calcium Sulphate Dihydrate	13397-24-5	CaSO ₄ 2H ₂ O	0-10
Calcium Carbonate	1317-65-3	CaCO ₃	0-5
Magnesium Oxide	1309-48-4	MgO	0-6
Calcium Oxide	1305-78-8	CaO	0-4
Crystalline Silica	14808-60-7	SiO ₂	0-0.75
Silica Amorphous, Fumed	7631-86-9	SiO ₂	10-15

Additionally, trace amounts of potassium and sodium compounds, chromium compounds, and nickel compounds may be present.

SECTION 2 - HAZARDOUS INGREDIENTS
Exposure Limits:

	OSHA TWA	ACGIH TVL TWA
Silica Fume Cement CAS #65997-15-1		
Up to 95% by weight		
Respirable Dust	5mg/m ³	
Total Dust	10mg/m ³	10mg/m ³
Calcium Sulphate Dihydrate CAS #13397-24-5		
Up to 10% by weight		
Respirable Dust	5mg/m ³	
Total Dust	15mg/m ³	10mg/m ³
Calcium Carbonate CAS #1317-65-3		
Up to 5% by weight		
Respirable Dust	5mg/m ³	
Total Dust	15mg/m ³	10mg/m ³
Crystalline Silica CAS #14808-60-7		
Up to 0.75% by weight		
Respirable Dust	0.1mg/m ³	0.1mg/m ³
Silica Fume, Amorphous CAS #7631-86-9		
Up to 12% by weight		
Respirable Dust	0.1mg/m ³	0.1mg/m ³
Total Dust	0.1mg/m ³	0.1mg/m ³
Magnesium Oxide CAS #1309-48-4		
Up to 6% by weight		
Nuisance Dust	10mg/m ³	10mg/m ³
Respirable Dust	5mg/m ³	2mg/m ³
Total Dust	5mg/m ³	5mg/m ³
Calcium Oxide CAS# 1306-78-8		
Up to 1.5% by weight		
Nuisance Dust	15mg/m ³	10mg/m ³
Respirable Dust	5mg/m ³	2mg/m ³
Total Dust	5mg/m ³	5mg/m ³
Hexavalent Chromium and other Chromates		.5mg(Cr)/m ³
Up to .003% by weight		
Total Respirable Dust	.01mg(CrO ₃)/m ³	

Trace Elements

As Silica Fume cement is made from materials mined from the earth and is processed using energy provided by fuels, trace amounts of naturally occurring, potentially harmful chemicals might show up during chemical analysis. For example, these products may contain up to 25% of insoluble residue, some of which may be

crystalline silica and fumed amorphous silica. Other trace components may include potassium and sodium sulphate compounds, chromium compounds and nickel compounds.

SECTION 3 - HAZARDS IDENTIFICATION

Emergency Overview

Silica Fume cement is a light grey powder that poses little immediate hazard. A single short-term exposure to the dry powder is not likely to cause serious harm. However, exposure of sufficient duration to wet Silica Fume cement can cause serious, potentially irreversible tissue (skin or eye) destruction in the form of chemical (caustic) burns, including third degree burns. The same type of tissue destruction can occur if wet or moist areas of the body are exposed for sufficient duration to dry Silica Fume cement.

Potential Health Effects

Relevant Routes of Exposure: eye contact, skin contact, inhalation, and ingestion.

Effects Resulting from Eye Contact:

Exposure to airborne dust may cause immediate or delayed irritation or inflammation. Eye contact by larger amounts of dry powder or splashes of wet Portland cement may cause effects ranging from moderate eye irritation to chemical burns and blindness. Such exposures require immediate first aid (see Section 4) and medical attention to prevent significant damage to the eye.

Effects Resulting from Skin Contact:

Discomfort or pain cannot be relied upon to alert a person to a hazardous skin exposure. Consequently, the only effective means of avoiding skin injury or illness involves minimizing skin contact, particularly contact with wet cement. Exposed persons may not feel discomfort until hours after the exposure have ended and significant injury has occurred.

Exposure to dry Silica Fume cement may cause drying of the skin with consequent mild irritation or more significant effects attributable to aggravation of other conditions. Dry Silica Fume cement contacting wet skin or exposure to moist or wet Silica Fume cement may cause more severe skin effects including thickening, cracking or fissuring of the skin. Prolonged exposure can cause severe skin damage in the form of (caustic) chemical burns.

Some individuals may exhibit an allergic response upon exposure to Silica Fume cement, possibly due to trace amounts of chromium. The response may appear in a variety of forms ranging from mild rash to severe skin ulcers. Persons already sensitized may react to their first contact with the product. Other persons may first experience this effect after years of contact with Silica Fume cement products.

Effects Resulting from Inhalation:

Silica Fume cement may contain trace amounts of free crystalline silica. Prolonged exposure to respirable free crystalline silica may aggravate other lung conditions. It also may cause delayed lung injury including silicosis, a disabling and potentially fatal lung disease, and/or other diseases. Also see Carcinogenic Potential below.

Exposure to Silica Fume cement may cause irritation to the moist membranes of the nose, throat, and upper respiratory system. It may also leave unpleasant deposits in the nose.

Effects Resulting from Ingestion:

Although small quantities of dust are not known to be harmful, ill effects are possible if larger quantities are consumed. Silica Fume cement should not be eaten.

International Agency for Research on Cancer (IARC), The National Toxicology Program (NTP) and Occupational Safety and Health Administration (OSHA) do not list Silica Fume cement as a carcinogen.

IARC has designated crystalline silica, a potential trace level contaminant in Silica Fume cement as carcinogenic to humans (Group 1). The NTP indicates that crystalline silica is reasonably anticipated to be a carcinogen (Group 2).

Medical conditions which may be aggravated by inhalation or dermal exposure:

- Pre-existing upper respiratory and lung diseases.
- Unusual (hyper) sensitivity to hexavalent chromium (chromium +6) salts.

SECTION 4 - FIRST AIDEyes:

Immediately flush eyes thoroughly with water. Continue flushing eye for at least 15 minutes, including under lids, to remove all particles. Call physician immediately.

Skin:

Wash skin with cool water and pH-neutral soap or a mild detergent intended for use on skin. Seek medical treatment in all cases of prolonged exposure to wet cement, cement mixtures, liquids from fresh cement products, or prolonged wet skin exposure to dry cement.

Inhalation of Airborne Dust:

Remove to fresh air. Seek medical help if coughing and other symptoms do not subside. Inhalation of gross amounts of Silica Fume cement requires immediate medical attention.

Ingestion:

Do not induce vomiting. If conscious, have the victim drink plenty of water and call a physician immediately.

SECTION 5 - FIRE & EXPLOSION DATA

Flash Point None
Lower Explosive Limit None
Upper Explosive Limit None
Auto Ignition Temperature Not Combustible
Extinguishing Media Not Combustible
Special Fire Fighting Procedures None

Although Silica Fume Cement poses no fire-related hazards, a self-contained breathing apparatus is recommended to limit exposure to combustion products when fighting any fire.

Hazardous Combustion Products None
Unusual Fire and Explosion Hazards None

SECTION 6 - ACCIDENTAL RELEASE MEASURES

Collect dry material using a scoop. Avoid actions that cause dust to become airborne. Avoid inhalation of dust and contact with skin. Wear appropriate personal protective equipment as described in Section 8.

Scrape up wet material and place in an appropriate container. Allow the material to dry before disposal. Do not attempt to wash Silica Fume cement down drains.

Dispose of waste material according to local, state and federal regulations.

SECTION 7 - HANDLING AND STORAGE

Keep Silica Fume cement dry until used. Normal temperatures and pressures do not affect the material. Promptly remove dusty clothing or clothing which is wet with cement fluids and launder before reuse. Wash thoroughly after exposure to dust or wet cement mixtures or fluids.

SECTION 8 - EXPOSURE CONTROLS/PERSONAL PROTECTIONSkin Protection:

Prevention is essential to avoiding potentially severe skin injury. Avoid contact with unhardened (wet) Silica Fume cement products. If contact occurs, promptly wash affected area with soap and water. Where prolonged exposure to unhardened Silica Fume cement products might occur, wear impervious clothing and gloves to eliminate skin contact. Where required, wear boots that are impervious to water to eliminate foot and ankle exposure.

Do not rely on barrier creams; barrier creams should not be used in place of gloves.

Periodically wash areas contacted by dry Silica Fume cement or by wet cement or concrete fluids with a pH neutral soap. Wash again at the end of the work. If irritation occurs, immediately wash the affected area and seek treatment. If clothing becomes saturated with wet concrete, it should be removed and replaced with clean dry clothing.

Respiratory Protection:

Avoid actions that cause dust to become airborne. Use local or general ventilation to control exposures below applicable exposure limits.

Use NIOSH/MSHA-approved (under 42 CFR 84) respirators in poorly ventilated areas, if an applicable exposure limit is exceeded, or when dust causes discomfort or irritation. Advisory: Respirators and filters purchased after July 10, 1998 must be certified under 42 CFR 84.

Ventilation:

Use local exhaust or general dilution ventilation to control exposure within applicable limits.

Eye Protection:

When engaged in activities where cement dust or wet cement or concrete could contact the eye, wear safety glasses with side shields or goggles. In extremely dusty environments and unpredictable environments wear unvented or indirectly vented goggles to avoid eye irritation or injury. Contact lenses should not be worn when working with Silica Fume cement or fresh cement products.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Grey or White Powder
Odour	No distinct Odour
Physical State	Solid (Powder)
pH in Water (ASTM D 1293-95)	12 to 13
Solubility in Water	Slightly Soluble (0.1 to 1.0%)
Vapour Pressure	Not Applicable
Vapour Density.....	Not Applicable
Boiling Point.....	Not Applicable (i.e., > 1000°C)
Melting Point.....	Not Applicable
Specific Gravity (H ₂ O = 1.0).....	2.95
Evaporation Rate	Not Applicable

SECTION 10 - STABILITY AND REACTIVITY

Stability:

Stable.

Conditions to Avoid:

Unintentional contact with water.

Incompatibility:

Wet Silica Fume cement is alkaline. As such, it is incompatible with acids, ammonium salts, and aluminum metal.

Hazardous Decomposition:

Will not spontaneously occur. Adding water results in hydration and produces (caustic) calcium hydroxide.

Hazardous Polymerization:

Will not occur.

SECTION 11 - TOXICOLOGICAL INFORMATION

For a description of available, more detailed toxicological information, contact the supplier or manufacturer.

SECTION 12 - ECOLOGICAL INFORMATIONEcotoxicity:

No recognized unusual toxicity to plants or animals.

Relevant physical and chemical properties:

See Sections 9 and 10.

SECTION 13 - DISPOSAL

Dispose of waste material according to local, state and federal regulations. Since Silica Fume cement is stable, uncontaminated material may be saved for future use.

Dispose of bags in an approved landfill or incinerator.

SECTION 14 - TRANSPORTATION DATAHazardous Material Description/Proper Shipping Name:

Silica Fume cement is not hazardous under U.S. Department of Transportation (DOT) regulations.

Hazard Class:

Not applicable.

Identification Number:

Not applicable.

Required Label Text:

Not applicable.

Hazardous Substances/Reportable Quantities (RO):

Not applicable.

SECTION 15 - OTHER REGULATORY INFORMATIONStatus under USDOL-OSHA Hazard Communication Rule, 29 CFR 1910.1200:

Silica Fume cement is considered a hazardous chemical under this regulation, and should be part of any hazard communication program.

Status under CERCLA/Superfund, 40 CFR 117 and 302:

Not listed.

Hazard Category under SARA (Title III), Sections 311 and 312:

Silica Fume cement qualifies as hazardous substance with delayed health effects.

Status under SARA (Title III), Section 313:

Not subject to reporting requirements under Section 313.

Status under TSCA (as of May 1997):

Some substances in Silica Fume cement are on the TSCA inventory list.

Status under the Federal Hazardous Substances Act:

Silica Fume cement is a hazardous substance subject to statutes promulgated under the subject act.

Status under California Proposition 65:

This product contains chemicals (trace metals) known to the State of California to cause cancer, birth defects or other reproductive harm. California law requires the manufacturer to give the above warning in the absence of definitive testing to prove that the defined risks do not exist.

Status under Canadian Environmental Protection Act:

Not listed.

Status under the Workplace Hazardous Materials Information System (WHMIS):

Silica Fume cement is considered to be a hazardous material under the Hazardous Products act as defined by the Controlled Products Regulations (Class E – Corrosive Material) and is therefore subject to the labelling and MSDS requirements of WHMIS.

Section 16 - OTHER INFORMATION

Revision date: September 2007

Date of previous MSDS: October 2004

Silica Fume cement should only be used by knowledgeable persons. A key to using the product safely requires the user to recognize that Silica Fume cement chemically reacts with water, and that some of the intermediate products of this reaction (that is, those present while a Silica Fume cement product is setting) pose a far more severe hazard than does Silica Fume cement itself.

While the information provided in this material safety data sheet is believed to provide a useful summary of the hazards of Silica Fume cement as it is commonly used, the sheet cannot anticipate and provide all of the information that might be needed in every situation. Inexperienced product users should obtain proper training before using this product. In particular, the data furnished in this sheet do not address hazards that may be posed by other materials mixed with Silica Fume cement to produce Silica Fume cement products. Users should review other relevant material safety data sheets before working with this Silica Fume cement or working on Silica Fume cement products, for example, Silica Fume cement concrete.

SELLER MAKES NO WARRANTY, EXPRESSED OR IMPLIED, CONCERNING THE PRODUCT OF THE MERCHANTABILITY OR FITNESS THEREOF FOR ANY PURPOSE OR CONCERNING THE ACCURACY OF ANY INFORMATION PROVIDED BY ST. MARYS CEMENT, EXCEPT THAT THE PRODUCT SHALL CONFORM TO CONTRACTED SPECIFICATIONS.

The information provided herein was believed by St. Marys Cement to be accurate at the time of preparation or prepared from sources believed to be reliable, but it is the responsibility of the user to investigate and understand other pertinent sources of information to comply with all laws and procedures applicable to the safe handling and use of product and to determine the suitability of the product for its intended use. Buyer's exclusive remedy shall be for damages and no claim of any kind, whether as for product delivered or for non-delivery of product, and whether based on contract, breach of warranty, negligence, or otherwise, shall be greater in amount than the purchase price of the quantity of product in respect of which damages are claimed. In no event shall Seller be liable for incidental or consequential damages, whether Buyer's claim is based on contract, breach of warranty, negligence or otherwise.

MATERIAL SAFETY DATA SHEET

Section I Substance Identification

Substance: Metal Bonded and Surface Set Corebits,
Diamond Impregnated

Emergency & Information:
Contact: P. Langan
Telephone: (801) 972-6430

Manufacturer:  **BOART LONGYEAR**
2340 W. 1700 S.
Salt Lake City, Utah 84104

Date Revised: 9/11/96
Approved by: R. Petersen

Section II Hazardous Ingredients/Identity Information

Diamond Impregnated Metal Bonded and Surface Set Corebits would normally be considered "Articles" under the OSHA Hazard Communication Standard (29 CFR 1910.1200) in that they do not "... release, or otherwise result in exposure to, a hazardous chemical, under normal conditions of use." However, it is recognized that, in rare instances, purchasers may drill, grind, weld, braze or cut the corebits such that metal dust or fume may be generated. Boart Longyear does not condone nor recommend such actions. This Material Safety Data Sheet has been prepared to provide information to those purchasers who may create airborne exposures to dust through drilling, grinding, welding, brazing, cutting or other mechanical means.

Corebits may contain the following hazardous components; OSHA Permissible Exposure Limits and ACGIH Threshold Limit Values are also listed:

Compound	CAS Number	Wt. %	OSHA PEL (mg/m ³)	ACGIH TLV /(STEL) (mg/m ³)	Carcinogen? (Y/N)
Cobalt	7440-48-4	0-25	0.05	0.02	N
Copper	7440-50-8	0-20	1.0	1.0	N
Tin	7440-31-5	0-5	2.0	2.0	N
Zinc	7440-66-6	0-10	15.0	10.0	N
Nickel	7440-02-0	0-3	1.0	1.0 ⁽¹⁾ [0.05]	Y [A1]
Iron	7439-89-6	0-80	15.0	10.0	N
Molybdenum	7439-98-7	0-20	15.0	10.0	N
Manganese	7439-96-5	0-5	5.0	0.2	N
Tungsten Carbide	12070-12-1	0-30	15.0	5.0/(10.0)	N
Tungsten	7440-33-7	0-30	15.0	5.0/(10.0)	N
Silicon	7440-21-3	0-0.2	15.0	10.0	N
Graphite (Synthetic)	7782-42-5	0-5	5.0 ⁽²⁾	2.0 ⁽²⁾	N
Silver	7440-22-4	0-10	0.01	0.1	N
Chromium Carbide	12012-35-0	0-1	0.5 ⁽³⁾	0.5 ⁽³⁾	N ⁽³⁾
Molybdenum Carbide	12069-89-5	0-3	15.0	10.0	N
Silicon Carbide	409-21-2	0-2	15.0	10.0	N

Note: PEL and TLVs are for total dust unless otherwise specified

(1) ACGIH Notice of Intended Changes, 1995-1996, will reduce nickel TLV to 0.05 mg/m³ and classify as an A1 carcinogen ("Confirmed Human Carcinogen")

(2) Respirable fraction of particulate

(3) PEL/TLV for chromium metal and Cr(III) compounds; not classifiable as a human carcinogen

Section III Physical/Chemical Characteristics

Boiling Point	N/A	Specific Gravity (H ₂ O = 1)	7-14
Vapor Pressure (mm Hg.)	N/A	Melting Point	800°C - 1,200°C
Vapor Density (AIR = 1)	N/A	Evaporation Rate	N/A
Solubility in Water	None	(Butyl Acetate = 1)	
Appearance and Odor:	Metal drill bit; odorless		

Section IV Fire and Explosion Hazard Data

The material is a nonflammable solid.

Section V Health Hazard Data

The toxicity of the metal alloy of the corebits has not been tested as a whole; this section of the MSDS presents health hazards of the metal components of the corebits. Most of the health effects discussed below are due to chronic exposure to the listed metals. Exposure to dust or fume from corebits is expected to be only very intermittent.

Route(s) of Entry: Primarily inhalation of dust or fumes produced from drilling, grinding or welding on the corebit; skin contact with dust, fumes or metal particles might also occur.

Health Hazards of Components**Cobalt**

Chronic over-exposure to cobalt dust or fumes can cause two types of lung lesions: interstitial fibrosis (so-called hard-metal pneumoconiosis) and occupational asthma. Signs and symptoms of asthma (cough, dyspnea, decreasing pulmonary function) usually improve with withdrawal from exposure. Hard-metal pneumoconiosis is a severe interstitial fibrosis which may develop after several years of exposure to cobalt-containing dust at concentrations in the order of 0.1 to 2 mg/m³.

Copper

Inhalation of copper dust and fumes can result in irritation of the upper respiratory tract. Signs and symptoms include ulceration and perforation of the nasal septum, and a metallic or sweet taste in the mouth. Copper fumes from welding may cause an influenza-like illness called "metal fume fever". Signs and symptoms include chills, muscle aches, nausea, fever, dry throat, cough, weakness and lassitude.

Tin

Prolonged over-exposure to tin dust and fume (tin oxide) can lead to a benign pneumoconiosis known as stannosis. No cases of massive fibrosis from overexposure to tin have been reported. In order to prevent stannosis, the TLV has been set at 2 mg/m³.

Nickel

The 1995-96 ACGIH TLV book Notice of Intended Changes, lists "Nickel, elemental, insoluble and soluble compounds, as Ni" as an A1 carcinogen (Confirmed Human Carcinogen) and lists an 8-hour time-weighted-average of 0.05 mg/m³; there is no Short-Term Exposure Limit for nickel. The International Agency for Research on Cancer (IARC) has classified nickel and some nickel compounds as carcinogens in experimental animals. Studies of exposures to nickel and nickel alloys in welders did not find increases in sinus or lung cancer, but the studies had marked limitations because of sample size and methodology. At present, there is no evidence of increased risk of lung cancer in welders exposed to nickel.

Inhalation of elemental nickel or other compounds of Ni dust or fumes can cause headache, vertigo, nausea and vomiting; chronic irritation of the upper and lower respiratory tracts. Signs and symptoms of upper respiratory tract irritation include rhinitis, sinusitis, perforation of nasal septum and loss of sense of smell. Chronic pulmonary irritation can lead to pulmonary fibrosis, bronchial asthma, and susceptibility to respiratory infections. Nickel can cause dermatitis in sensitive individuals.

Manganese

Over-exposure to airborne manganese dust can lead to manganese toxicity of the brain and the lungs. Heavy dust exposure for as long as three months can lead to toxicity to the lungs manifest as increased susceptibility to bronchitis or more serious cases of manganic pneumonia. The toxicity to the brain is manifested as a chronic disorder of the central nervous system resembling Parkinson's disease.

Graphite (synthetic)

Chronic exposure from inhalation of graphite dust can result in a lung condition that resembles Coal Worker's pneumoconiosis. Signs and symptoms include dyspnea, cough, expectoration of black sputum, chest tightness, and occasionally pain.

Silver

Overexposure to airborne silver dust or fume (and, perhaps, repeated skin contact with silver) may result in Argyria, a cosmetic defect which consists of an unsightly blue-gray discoloration of the skin, mucous membranes and eyes. Silver exposure does not appear to cause any systemic effects. Signs and symptoms may be localized in the skin, eyes or mucous membranes, appearing as gray-blue patches, without evidence of tissue reaction.

Chromium

The toxicity of chromium compounds appears to vary markedly with the valence of chromium--hexavalent (Cr VI) compounds appear to be carcinogenic, while chromium metal, bivalent (Cr II), and trivalent (Cr III) have not been shown to be carcinogenic. While the exact valence of chromium in the corebit alloy is not certain, it is highly unlikely that Cr VI would exist in the alloy. The toxicity of chromium metal, divalent and trivalent compounds is low, and the TLV of 0.5 mg/m^3 is considered adequate to prevent pulmonary disease or other toxic effect.

Emergency and First-Aid Procedures:

Eye contact: Wash eyes with water to flush out dust particles.

Skin contact: Wash exposed skin with soap and water to remove dust.

Section VI Reactivity Data

Stability: Stable, hazardous polymerization will not occur.

Conditions to avoid: None

Hazardous decomposition products: None

Materials to avoid: None

Section VII Spill & Leak Procedures

- Normal materials handling procedures may be followed in clean-up operations; standard techniques should be used to minimize dust generation (e.g., wetting).

Section VIII Control Measures

- Respiratory Protection: Where respiratory protection is required, use only NIOSH/MSHA approved respirators and meet all other requirements of the OSHA Respiratory Protection standard (29 CFR 1910.134). During operations in which the PEL might be exceeded for any component of the corebits, the minimum recommended respirator is a half-face mask with HEPA filters.
- In indoor operations, use local exhaust, general ventilation, or wetting to meet TLV requirements if dust is generated.
- Use leather or equivalent protective gloves to prevent cuts and abrasions.
- Use industrial safety glasses with side shields or goggles for eye protection.

Section IX Precautions for Safe Handling and Use

- Incorporate dust control measures that maintain total and respirable dust concentrations below PELs and TLVs.
- Minimize direct skin contact with dust by using coveralls, long sleeves, and gloves.



CAMEO Chemicals

 [Print](#)

Chemical Datasheet

GAS OIL

2
0 0

Chemical Identifiers

UN/NA Number	CAS Number	CHRIS Code	DOT Hazard Label
1202	none	GOC	FLAMMABLE LIQUID

NFPA 704: Red 2 -- Flammability: Ignites when moderately heated
 Blue 0 -- Health Hazard: Like ordinary material
 Yellow 0 -- Reactivity: Normally stable

General Description

A straw yellow to dark liquid with a petroleum-like odor. Flash point between 73.4-142°F. Boiling range 450-800°F. Less dense than water and insoluble in water. Hence floats on water. Vapors are heavier than air.

Hazards

Reactivity Alerts

 Highly Flammable

Air & Water Reactions

Highly flammable. Insoluble in water.

Fire Hazard

HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks). Vapor explosion hazard indoors, outdoors or in sewers. Runoff to sewer may create fire or explosion hazard. Containers may explode when heated. Many liquids are lighter than water. Substance may be transported hot. If molten aluminum is involved, refer to GUIDE 169 below.

GUIDE 169: Substance is transported in molten form at a temperature above 705° C (1300° F). Violent reaction with water; contact may cause an explosion or may produce a flammable gas. Will ignite combustible materials (wood, paper, oil, debris, etc.). Contact with nitrates or other oxidizers may cause an explosion. Contact with containers or other materials, including cold, wet or dirty tools, may cause an explosion. Contact with concrete will cause spalling and small pops. (ERG, 2008)

Health Hazard

INHALATION: causes irritation of upper respiratory tract; stimulation, then depression; dizziness, headache, incoordination, anesthesia, coma, respiratory arrest; irregular heartbeat is a complication. **ASPIRATION:** causes severe coughing, gagging, distress, rapid development of pulmonary edema. **INGESTION:** causes irritation of throat and stomach; stimulation, then depression. (USCG, 1999)

Reactivity Profile

Saturated aliphatic hydrocarbons, which are contained in GAS OIL, may be incompatible with strong oxidizing agents such as nitric acid. Charring may occur followed by ignition of unreacted hydrocarbon and other nearby combustibles. In other settings, mostly unreactive. Not affected by aqueous solutions of acids, alkalis, most oxidizing agents, and most reducing agents. When heated sufficiently or when ignited in the presence of air, oxygen or strong oxidizing agents, burns exothermically.

Belongs to the Following Reactive Group(s)

- Hydrocarbons, Aliphatic Saturated

Response Recommendations

Firefighting

Do not extinguish fire unless flow can be stopped. Use water in flooding quantities as fog. Solid streams of water may spread fire. Cool all affected containers with flooding quantities of water. Apply water from as far a distance as possible. Use foam, dry chemical, or carbon dioxide. (AAR, 2003)

Non-Fire Response

Keep sparks, flames, and other sources of ignition away. Keep material out of water sources and sewers. Build dikes to contain flow as necessary. Use water spray to knock-down vapors. Land spill: Dig a pit, pond, lagoon, holding area to contain liquid or solid material. Dike surface flow using soil, sand bags, foamed polyurethane, or foamed concrete. Absorb bulk liquid with fly ash, cement powder, or commercial sorbents. Water spill: Use natural barriers or oil spill control booms to limit spill travel. Remove trapped material with suction hoses. (AAR, 2003)

Protective Clothing

Protective goggles, gloves. (USCG, 1999)

First Aid

Get medical attention.

INHALATION: maintain respiration; administer oxygen if needed.

ASPIRATION: enforce bed rest and administer oxygen.

INGESTION: give victim water or milk; do NOT induce vomiting; guard against aspiration into lungs.

EYES: wash with copious quantity of water.

SKIN: remove by wiping, then wash with soap and water. (USCG, 1999)

Physical Properties

Molecular Formula: data unavailable

Flash Point: 150.0 ° F (USCG, 1999)

Lower Explosive Limit: 6.0 % (USCG, 1999)

Upper Explosive Limit: 13.5 % (USCG, 1999)

Autoignition Temperature: 640.0 ° F (USCG, 1999)

Melting Point: data unavailable

Vapor Pressure: data unavailable

Vapor Density: data unavailable

Specific Gravity: 0.848 at 60.8 ° F (USCG, 1999)

Boiling Point: 375 to 750 ° F at 760.0 mm Hg (USCG, 1999)

Molecular Weight: data unavailable

Water Solubility: data unavailable

AEGL: data unavailable

ERPG: data unavailable

TEEL: data unavailable

IDLH: data unavailable

Regulatory Information

Regulatory Names: none

CAA RMP: Not a regulated chemical.

CERCLA: Not a regulated chemical.

EHS (EPCRA 302): Not a regulated chemical.

TRI (EPCRA 313): Not a regulated chemical.

RCRA Chemical Code: none

Alternate Chemical Names

- ACEITE MINERAL PARA CALDEO (DOT SPANISH)
- COMBUSTOLEO (DOT SPANISH)
- COMBUSTOLEO NÚMERO 1, 2, 4, 5, 6 (DOT SPANISH)
- DIESEL (DOT FRENCH)
- DIESEL COMBUSTIBLE (DOT SPANISH)
- DIESEL FUEL
- ESSENCE DIESEL (DOT FRENCH)
- FUEL OIL
- FUEL OIL, NO. 1,2,4,5,6
- GAS OIL: CRACKED
- GASOLEO (DOT SPANISH)
- GAZOLE (DOT FRENCH)
- HEATING OIL, LIGHT
- HUILE DE CHAUFFE, LÉGÈRE (DOT FRENCH)
- HUILE À DIESEL (DOT FRENCH)
- HUILE À DIESEL, NO. 1,2,4,5 OU 6 (DOT FRENCH)

Material Safety Data Sheet

MSDS#: 142-18

Page 1 of 2

Sanford Corporation
2711 Washington Boulevard
Bellwood, IL 60104

Telephone Number: 1-800-323-0749
Initiated By: Susan Nyborg
Date of Last Revision: June 1, 2001
Medical Emergency No: 1-800-228-5635

Section One: Product Identification

Product Name: Expo_R Cleaner for Dry Erase Surfaces

Colors: Clear

Sanford Corporation is a member of The Art and Creative Materials Institute, Inc. This product is certified by the Institute to be labeled in accordance with the voluntary chronic hazard labeling standard ASTM D4236 and is labeled with the CL Cautionary Label Seal. Products bearing the CL Seal are certified to be properly labeled in a program of toxicological evaluation by a medical expert for any known health risks and with information on the safe and proper use of these materials. Conforms to ASTM D4236. This MSDS is applicable for the consumer use of the following product numbers: 81801, 81803

Section Two: Composition

Water, isopropyl alcohol (67-63-0), ethylene glycol monobutyl ether (111-76-2)

Section Three: Physical and Chemical Characteristics

For isopropanol:

Boiling Point:	180°F at 760 mm Hg
Vapor Pressure (mm Hg):	33 mm Hg at 68°F
Specific Gravity:	0.78 at 77°F
Solubility in Water:	Not available
Appearance and Odor:	Clear liquid; characteristic alcohol odor
Evaporation Rate:	7.7 (ethyl ether = 1)

Section Four: Fire and Explosion Hazard Data

Flash Point (Method Used):	105°F (TCC) for mixture
Flammability Limits (% by volume):	Lower: 2.5% for isopropanol Upper: Not available
Extinguishing Medium:	N/A
Special Fire Fighting Procedures:	N/A
Unusual Fire and Explosion Hazards:	N/A

Section Five: Reactivity Data

Stability:	Stable
Conditions to Avoid:	Avoid extreme heat and flame.
Chemical Incompatibility:	None known
Hazardous Decomposition:	None known
Hazardous Polymerization:	Will not occur.

Section Six: Health Hazard Data

Chemicals Listed as Carcinogens or Potential Carcinogen:

IARC Monographs:	No
National Toxicology Program:	No
OSHA Regulated:	No

WARNING: FLAMMABLE. MAY BE HARMFUL BY INGESTION OR BY SKIN CONTACT. MAY BE HARMFUL IF SWALLOWED. EYE IRRITANT. CONTAINS: 2-BUTOXY ETHANOL/ACETATE, ISOPROPYL ALCOHOL.
 PRECAUTIONS: Avoid ingestion. Keep away from eyes. Do not store or use near heat or flame. KEEP OUT OF REACH OF CHILDREN. FIRST AID: If eye contact occurs, rinse with tap water for 5-10 minutes. If irritation persists, seek medical care. If skin contact occurs, wash with soap and water for 5 minutes. If swallowed, get prompt medical attention. For further health information, contact a poison control center or call 1-800-228-5635.

Section Seven: Precautions for Safe Handling and Use

Steps to Be Taken in Case Material Is Released or Spill:	Wipe up with absorbent material.
Waste Disposal Method:	Dispose in accordance with Federal, State, and Local Regulations.
Precautions to Be Taken in Handling and Storage:	Use in a well-ventilated area.
Other Precautions:	Aim nozzle away from eyes.

Section Eight: Personal Protection and Exposure Control Measures

Eye Protection:	None under normal use conditions. Avoid eye contact.
Skin Protection:	None under normal use conditions. Avoid prolonged skin contact.
Respiratory Protection:	None under normal use conditions.
Ventilation:	Use in a well-ventilated area.
Protective Clothing:	None under normal use conditions.

HMIS Code	
Health	2
Flammability	2
Reactivity	0
Personal Protection	N/A

Sanford Corporation has been advised by council that the OSHA Hazard Communication Standard does not apply to the Sanford product described in this MSDS. The reason for the exemption is contained in 29 CFR 1910.1200 (b)(6)(ix), as amended July 1, 1994, per the Code of Federal Regulations. The information contained in this MSDS is forwarded to you for your information, but is not meant to imply that the product is covered by the Hazard Communication Standard, nor is the MSDS meant to comply with all the requirements of the Hazard Communication Standard.

0 = Minimal / 4 = Severe Hazard

MATERIAL SAFETY DATA SHEET

CHEMCO INDUSTRIES, INC.
5731 Manchester Ave., St. Louis, MO 63110



DATE OF ISSUE: January, 05, 2006

GENERAL INFORMATION # : 314-647-1888
EMERGENCY TELEPHONE # : (800) 854-4236

I-PRODUCT IDENTIFICATION

DRY GAS

PRODUCT CODE: #082, #083

CHEMICAL FORMULATION: JELLING GAS & DIESEL ADDITIVE

NFPA HAZARD IDENTIFICATION SYSTEM: HEALTH: FLAMMABILITY: REACTIVITY:

HAZARD RATING: 4 - Extreme; 3 - High; 2 - Moderate; 1 - Slight; 0 - Insignificant

II - HAZARDOUS INGREDIENTS

Hazardous Components (Specific Chemical Identity; Common Name (s))	CAS No.	OSHA PEL	ACGIH TLV	WEIGHT %
CONTAINS METHYL ALCOHOL, XYLENE, CRESOLS, ALOPHATIC DISTILLATES, HYDROCARBONS AND EMULSIFIERS				

Key: PEL: Permissible Exposure Limit TLV: Threshold Limit Value C: Ceiling Level STEL: Short Term Exposure Limit
N/A: Not Applicable N/D: Not Determined N/E: Not Established Y: Yes N: No
302: CERCLA List of Hazardous Substances and Reportable Quantities (40 CFR 302.4).
355: SARA TITLE III/ List of Extremely Hazardous Substances for Emergency Planning and Notification (40 CFR 355).
372: SARA TITLE III/ List of Toxic Chemicals subject to Release Reporting (Community Right to Know) (40 CFR 372).

III - PHYSICAL DATA

BOILING POINT (°f): N/A MELTING POINT: N/A
VAPOR PRESSURE (mm Hg): N/A SPECIFIC GRAVITY (H20=1): 0.96
VAPOR DENSITY (AIR=1) N/A
SOLUBILITY IN WATER: EMULSIFIABLE EVAPORATION RATE (Butyl Acetate=1): N/A
pH: N/A
APPEARANCE AND ODOR: AMBER TO CLEAR LIQUID, AROMATIC ODOR

IV - FIRE AND EXPLOSION HAZARD

FLASH POINT (Method used): APPROX. 115°F (ICC) (TEST METHOD):
FLAMMABLE LIMITS: NO DATA UPPER: N/E LOWER: N/E
EXTINGUISHING MEDIA: CARBON MONOXIDE, DRY CHEMICALS, WATER SPRAY, FOAM
SPECIAL FIRE FIGHTING PROCEDURES: AVOID STRAIGHT WATER STREAM, AVOID INHALATION OF COMBUSTION PRODUCTS. (MAY BE TOXIC AND CORROSIVE)
UNUSUAL FIRE AND EXPLOSION HAZARD: AVOID CONCENTRATED VAPOR ACCUMULATION

V - REACTIVITY DATA

STABILITY: UNSTABLE
INCOMPATIBILITY: STRONG OXIDIZERS
CONDITIONS TO AVOID: HEAT, SPARK, FLAMES
HAZARDOUS DECOMPOSITION OR BYPRODUCTS: INCOMPLETE COMBUSTION MAY LEAD TO CARBON MONOXIDE
HAZARDOUS POLYMERIZATION: WILL NOT OCCUR
CONDITIONS TO AVOID: NONE

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: DRY GAS

PRODUCT CODE: #082, #083

VI - HEALTH AND HAZARD DATA

PRIMARY ROUTE(S) OF ENTRY: EYES, INGESTION

CARCINOGENICITY: N/A

SYMPTOMS OF EXPOSURE

IF IN EYES: IRRITATION

IF INGESTED: HARMFUL OR FATAL IF SWALLOWED

EMERGENCY FIRST AID

IF IN EYES: FLUSH EYES WITH WATER THOROUGHLY. SEEK MEDICAL HELP

IF ON SKIN: WASH SKIN WITH SOAP AND WATER

IF INGESTED: DO NOT INDUCE VOMITING. CALL A PHYSICIAN

VII - SPILL AND LEAK PROTECTION

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: VENTILATE THE AREA, ELIMINATE ALL IGNITION SOURCES, COLLECT SPILL WITH AN ABSORBENT

WASTE DISPOSAL METHOD: MATERIAL MAY BE INCINERATED. HOWEVER, CONFORM TO ALL EXISTING FEDERAL AND LOCAL POLLUTION LAWS.

VIII - SPECIAL PROTECTION INFORMATION

VENTILATION: LOCAL EXHAUST: RECOMMENDED

RESPIRATORY PROTECTION: RECOMMENDED

PROTECTIVE GLOVES: RECOMMENDED

EYE PROTECTION: RECOMMENDED

OTHER PROTECTIVE EQUIPMENT: NONE

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: AVOID SPILLS ON CLOTHING OR SKIN

OTHER PRECAUTIONS: KEEP OUT OF REACH OF CHILDREN

WORK/HYGIENIC PRACTICES: N/A

REVISION DATE: January 05, 2005

Prepared By:

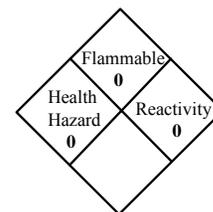
DATE OF ISSUE: January 05, 2005

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WYO-BEN, INC.

MATERIAL SAFETY DATA SHEET



NFPA FIRE HAZARD
IDENTIFICATION SYSTEM

I. PRODUCT IDENTIFICATION

Trade Name(s): **ENVIROPLUG® No. 16**

Generic Name(s): Wyoming (Western) Bentonite; Bentonite Clay (CAS No. 1302-78-9)

Chemical Name(s): Sodium Montmorillonite (CAS No. 1318-93-0)

Manufacturer: **WYO-BEN, INC.**
Address: P.O. Box 1979
Billings, Montana 59103

Telephone Numbers:
Information: (406) 652-6351
EMERGENCY: (406) 652-6351

II. HAZARDOUS INGREDIENTS

Ingredient	CAS NO.	%	Hazard
Crystalline Silica (SiO ₂) as Quartz	14808-60-7	See Note	Low concentrations of crystalline silica (SiO ₂) in the form of quartz may be present in airborne bentonite dust. See Section VI for discussion of health hazard.

Note: Although the typical quartz content of western bentonite is in the range of 2 to 6% most of the quartz particles are larger than the 10 μ respirable threshold size. The actual respirable quartz concentration in airborne bentonite dust will depend upon bentonite source, fineness of product, moisture content of product, local humidity and wind condition at point of use and other use specific factors.

III. PHYSICAL DATA

Boiling Point (°F): NA	Specific Gravity (H ₂ O=1): 2.45-2.55
Vapor Pressure (mm. Hg): NA	Melting Point: Approx. 1450°C
Vapor Density (Air = 1): NA	Evaporation Rate (Butyl Acetate = 1): NA
Solubility in Water: Insoluble, forms colloidal suspension.	pH: 8-10 (5% aqueous suspension)
Density (at 20° C): 55-68 lbs./cu.ft. as product.	
Appearance and Odor: Bluegray to green as moist solid, light tan to gray as dry powder. No odor.	

IV. FIRE AND EXPLOSION DATA

Flash Point: NA	Flammable Limits: LEL: NA UEL: NA
Special Fire Fighting Procedures: NA	
Unusual Fire and Explosion Hazards: None. Product will not support combustion.	
Extinguishing Media: None for product. Any media can be used for the packaging. Product becomes slippery when wet.	

V. REACTIVITY

Stability: Stable
Hazardous Polymerization: None
Incompatibility: None
Hazardous Decomposition Products: None
NA = Not Applicable ND = Not Determined

VI. HEALTH HAZARD INFORMATION

Routes of Exposure and Effects:

Skin: Possible drying resulting in dermatitis.

Eyes: Mechanical irritant.

Inhalation: *Acute* (short term) exposure to dust levels exceeding the PEL may cause irritation of respiratory tract resulting in a dry cough. *Chronic* (long term) exposure to airborne bentonite dust containing respirable size ($\leq 10 \mu\text{m}$) quartz particles, where respirable quartz particle levels are higher than TLV's, may lead to development of silicosis or other respiratory problems. Persistent dry cough and labored breathing upon exertion may be symptomatic.

Ingestion: No adverse effects.

Permissible Exposure Limits:

(for air contaminants)

Bentonite as "Particulates not otherwise regulated"
(formerly nuisance dust)

Total dust

Respirable dust

Crystalline Silica: Quartz (respirable)

OSHA PEL

(8hr. TWA)

15mg/m³

5mg/m³

10 mg/m³

% Silica + 2

ACGIH TLV

ND

ND

0.025 mg/m³

Carcinogenicity: Bentonite is not listed by ACGIH, IARC, NTP or OSHA. IARC, 1997, concludes that there is sufficient evidence in humans for the carcinogenicity of inhaled crystalline silica from occupational sources (IARC Class 1), that carcinogenicity was not detected in all industrial circumstances studied and that carcinogenicity may depend on characteristics of the crystalline silica or on external factors affecting its biological activity. NTP classifies respirable crystalline silica as "known to be a human carcinogen" (NTP 9th Report on Carcinogens – 2000). ACGIH classifies crystalline silica, quartz, as a suspected human carcinogen (A2).

Acute Oral LD₅₀: ND

Acute Dermal LD₅₀: ND

Aquatic Toxicology LC₅₀: ND

Emergency and First Aid Procedures:

Skin: Wash with soap and water until clean.

Eyes: Flush with water until irritation ceases.

Inhalation: Move to area free from dust. If symptoms of irritation persist contact physician. Inhalation may aggravate existing respiratory illness.

VII. HANDLING AND USE PRECAUTIONS

Steps to be Taken if Material is Released or Spilled: Avoid breathing dust; wear respirator approved for silica bearing dust. Vacuum up to avoid generating airborne dust. Avoid using water. Product slippery when wetted.

Waste Disposal Methods: Product should be disposed of in accordance with applicable local, state and federal regulations.

Handling and Storage Precautions: Use NIOSH/MSHA respirators approved for silica bearing dust when free silica containing airborne bentonite dust levels exceed PEL/TLV's. Clean up spills promptly to avoid making dust. Storage area floors may become slippery if wetted.

VIII. INDUSTRIAL HYGIENE CONTROL MEASURES

Ventilation Requirements: Mechanical, general room ventilation. Use local ventilation to maintain PEL's/TLV's.

Respirator: Use respirators approved by NIOSH/MSHA for silica bearing dust.

Eye Protection: Generally not necessary. Personal preference.

Gloves: Generally not necessary. Personal preference.

Other Protective Clothing or Equipment: None

IX. SPECIAL PRECAUTIONS

Avoid prolonged inhalation of airborne dust.

DEPARTMENT OF TRANSPORTATION HAZARDOUS MATERIAL INFORMATION

Shipping Name: NA (Not Regulated)

Hazard Class: NA

Hazardous Substance: NA

Caution Labeling: NA

Date Prepared: October 5, 2007

Doc #4230-16:

All information presented herein is believed to be accurate; however, it is the user's responsibility to determine in advance of need that the information is current and suitable for their circumstances. No warranty or guarantee, expressed or implied is made by WYO-BEN, INC. as to this information, or as to the safety, toxicity or effect of the use of this product.



CAMEO Chemicals



Chemical Datasheet

GASOLINE

3
1 0

Chemical Identifiers

UN/NA Number	CAS Number	CHRIS Code	DOT Hazard Label
1203	8006-61-9 86290-81-5	GAT	FLAMMABLE LIQUID

NFPA 704: Red 3 -- Flammability: Ignites at normal temperatures
Blue 1 -- Health Hazard: Slightly hazardous
Yellow 0 -- Reactivity: Normally stable

General Description

A clear colorless to amber colored, volatile liquid with a petroleum-like odor. Flash point below 0°F. Less dense than water and insoluble in water. Hence floats on water. Vapors heavier than air. Leaked vapors may travel to a source of ignition and then flash back to the source.

Hazards

Reactivity Alerts

 Highly Flammable

Air & Water Reactions

Highly flammable.

Fire Hazard

Special Hazards of Combustion Products: None

Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back. (USCG, 1999)

Health Hazard

Irritation of mucous membranes and stimulation followed by depression of central nervous system. Breathing of vapor may also cause dizziness, headache, and incoordination or, in more severe cases, anesthesia, coma, and respiratory arrest. If liquid enters lungs, it will cause severe irritation, coughing, gagging, pulmonary edema, and, later, signs of bronchopneumonia and pneumonitis. Swallowing may cause irregular heartbeat. (USCG, 1999)

Reactivity Profile

GASOLINE may be incompatible with strong oxidizing agents such as nitric acid, peroxides, and perchlorates. Charring may occur followed by ignition of unreacted hydrocarbon and other nearby combustibles. In other settings, mostly unreactive. Not affected by aqueous solutions of acids, alkalis, most oxidizing agents, and most reducing agents. When heated sufficiently or when ignited in the presence of air, oxygen or strong oxidizing agents, burns exothermically to produce carbon dioxide and water.

Belongs to the Following Reactive Group(s)

- Hydrocarbons, Aliphatic Saturated

Response Recommendations

Firefighting

Do not extinguish fire unless flow can be stopped. Use water in flooding quantities as fog. Solid streams of water may spread fire. Cool all affected containers with flooding quantities of water. Apply water from as far a distance as possible. Use foam, dry chemical, or carbon dioxide. (AAR, 2003)

Non-Fire Response

Keep sparks, flames, and other sources of ignition away. Keep material out of water sources and sewers. Build dikes to contain flow as necessary. Attempt to stop leak if without undue personnel hazard. Use water spray to knock-down vapors. (AAR, 2003)

Protective Clothing

Skin: Wear appropriate personal protective clothing to prevent skin contact.

Eyes: Wear appropriate eye protection to prevent eye contact.

Wash skin: The worker should immediately wash the skin when it becomes contaminated.

Remove: Work clothing that becomes wet should be immediately removed due to its flammability hazard(i.e. for liquids with flash point < 100°F)

Change: No recommendation is made specifying the need for the worker to change clothing after the work shift.

Provide: Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substance; this is irrespective of the recommendation involving the wearing of eye protection. Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility of exposure. [Note: It is intended that these facilities provide a sufficient quantity or flow of water to quickly remove the substance from any body areas likely to be exposed. The actual determination of what constitutes an adequate quick drench facility depends on the specific circumstances. In certain instances, a deluge shower should be readily available, whereas in others, the availability of water from a sink or hose could be considered adequate.] (NIOSH, 2003)

_____ Dupont Average Standardized Breakthrough Times _____
(for GASOLINE, LEADED)

Tychem® BR

greater than 480 min. (concentration: 95+%)

Tychem® CPF2

immediate (less than 10 min.) (concentration: MIXTURE)

Tychem® CPF3
greater than 480 min. (concentration: MIXTURE)
Tychem® CPF4
immediate (less than 10 min.) (concentration: 95+%)
Tychem® F
30 min. (concentration: 95+%)
Tychem® LV
greater than 480 min. (concentration: 95+%)
Tychem® Reflector®
greater than 480 min. (concentration: 95+%)
Tychem® Responder®
greater than 480 min. (concentration: 95+%)
Tychem® Responder® CSM
greater than 480 min. (concentration: 95+%)
Tychem® SL
immediate (less than 10 min.) (concentration: 95+%)
Tychem® ThermoPro
30 min. (concentration: 100%)
Tychem® TK
greater than 480 min. (concentration: 95+%) (DuPont, 2008)

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First Aid

Eye: If this chemical contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

Skin: If this chemical contacts the skin, immediately flush the contaminated skin with soap and water. If this chemical penetrates the clothing, immediately remove the clothing and flush the skin with water. If irritation persists after washing, get medical attention.

Breathing: If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform mouth-to-mouth resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.

Swallow: If this chemical has been swallowed, get medical attention immediately. (NIOSH, 2003)

Physical Properties

Molecular Formula: data unavailable

Flash Point: -36.0 ° F (USCG, 1999)

Lower Explosive Limit: 1.4 % (USCG, 1999)

Upper Explosive Limit: 7.4 % (USCG, 1999)

Autoignition Temperature: 853.0 ° F (USCG, 1999)

Melting Point: data unavailable

Vapor Pressure: 382.58 mm Hg (USCG, 1999)

Vapor Density: data unavailable

Specific Gravity: 0.7321 at 68.0 ° F (USCG, 1999)

Boiling Point: 140 to 390 ° F at 760.0 mm Hg (USCG, 1999)

Molecular Weight: 72.0 (approx) (NIOSH, 2003)

Water Solubility: Insoluble (NIOSH, 2003)

AEGL: data unavailable

ERPG: data unavailable

TEEL-1

500.0 ppm for CAS 8006-61-9
(SCAPA, 2008)

TEEL-2

500.0 ppm for CAS 8006-61-9

TEEL-3

1500.0 ppm for CAS 8006-61-9

IDLH: A potential human carcinogen. (NIOSH, 2003)

Regulatory Information

Regulatory Names: none

CAA RMP: Not a regulated chemical.

CERCLA: Not a regulated chemical.

EHS (EPCRA 302): Not a regulated chemical.

TRI (EPCRA 313): Not a regulated chemical.

RCRA Chemical Code: none

Alternate Chemical Names

- A 76
- A 76 (FUEL)
- AI 3
- AI 93 (FUEL)
- AKVAZIN
- BENZINE (MOTOR FUEL)
- COMBUSTIBLE PARA MOTOR (DOT SPANISH)
- ESSENCE (DOT FRENCH)
- ESSENCE POUR MOTEURS D'AUTOMOBILE (DOT FRENCH)
- FUELS, GASOLINE
- GASOLINA (DOT SPANISH)
- GASOLINE, SYNTHETIC
- GASOLINES: AUTOMOTIVE (<4.23G LEAD/GAL)
- HERBICIDE ES
- INDOLENE
- MOTOR FUEL
- MOTOR SPIRIT
- MOTOR SPIRITS
- NATURAL GAS CONDENSATES, GASOLINE
- NATURAL GASOLINE
- NEFRAS S 150/200
- NEFRAS S 50/170
- PETROL
- PETROL, NATURAL
- PETROL, SYNTHETIC
- SYNFUELS
- SYNTHETIC GASOLINE

Product Name: MOBILTEMP SHC 32
Revision Date: 01Dec2005
Page 1 of 8

MATERIAL SAFETY DATA SHEET

SECTION 1

PRODUCT AND COMPANY IDENTIFICATION

PRODUCT

Product Name: MOBILTEMP SHC 32
Product Description: Synthetic Base Stocks and Additives
Product Code: 640219-00, 970894
Intended Use: Grease

COMPANY IDENTIFICATION

Supplier: EXXON MOBIL CORPORATION
3225 GALLOWS RD.
FAIRFAX, VA. 22037 USA

24 Hour Health Emergency 609-737-4411
Transportation Emergency Phone 800-424-9300
ExxonMobil Transportation No. 281-834-3296
MSDS Requests 713-613-3661
Product Technical Information 800-662-4525, 800-947-9147
MSDS Internet Address <http://www.exxon.com>, <http://www.mobil.com>

SECTION 2

COMPOSITION / INFORMATION ON INGREDIENTS

Reportable Hazardous Substance(s) or Complex Substance(s)

Name	CAS#	Concentration*
1-NAPHTHYLAMINE, N-PHENYL-	90-30-2	0.1 - 1.0%
PENTAERYTHRITOL	115-77-5	1 - 5%
SODIUM NITRITE	7632-00-0	0.1 - 1.0%

* All concentrations are percent by weight unless material is a gas. Gas concentrations are in percent by volume.

SECTION 3

HAZARDS IDENTIFICATION

This material is not considered to be hazardous according to regulatory guidelines (see (M)SDS Section 15).

POTENTIAL HEALTH EFFECTS

Low order of toxicity. Excessive exposure may result in eye, skin, or respiratory irritation. High-pressure injection under skin may cause serious damage.

ENVIRONMENTAL HAZARDS

Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

NFPA Hazard ID: Health: 0 Flammability: 1 Reactivity: 0
HMIS Hazard ID: Health: 0 Flammability: 1 Reactivity: 0

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary

from person to person.

SECTION 4	FIRST AID MEASURES
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INHALATION

Under normal conditions of intended use, this material is not expected to be an inhalation hazard.

SKIN CONTACT

Wash contact areas with soap and water. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

EYE CONTACT

Flush thoroughly with water. If irritation occurs, get medical assistance.

INGESTION

First aid is normally not required. Seek medical attention if discomfort occurs.

SECTION 5	FIRE FIGHTING MEASURES
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EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO₂) to extinguish flames.

Inappropriate Extinguishing Media: Straight Streams of Water

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply. Firefighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Hazardous Combustion Products: Aldehydes, Oxides of carbon, Sulfur oxides, Smoke, Fume, Incomplete combustion products

FLAMMABILITY PROPERTIES

Flash Point [Method]: >204°C (400°F) [EST. FOR OIL, ASTM D-92 (COC)]

Flammable Limits (Approximate volume % in air): LEL: N/D UEL: N/D

Autoignition Temperature: N/D

SECTION 6	ACCIDENTAL RELEASE MEASURES
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NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations. U.S. regulations require reporting releases of this material to the environment which exceed the reportable quantity or oil spills which could reach any waterway including intermittent dry creeks. The National

Product Name: MOBILTEMP SHC 32

Revision Date: 01Dec2005

Page 3 of 8

Response Center can be reached at (800)424-8802.

SPILL MANAGEMENT

Land Spill: Allow spilled material to solidify and scrape up with shovels into a suitable container for recycle or disposal.

Water Spill: Stop leak if you can do it without risk. Confine the spill immediately with booms. Skim from surface.

Water spill and land spill recommendations are based on the most likely spill scenario for this material; however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7 HANDLING AND STORAGE

HANDLING

Prevent small spills and leakage to avoid slip hazard.

Static Accumulator: This material is not a static accumulator.

STORAGE

Do not store in open or unlabelled containers.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE LIMIT VALUES

Exposure limits/standards (Note: Exposure limits are not additive)

Source	Form	Limit / Standard			Note	Source
PENTAERYTHRITOL	Respirable fraction.	TWA	5 mg/m ³		N/A	OSHA Z1
PENTAERYTHRITOL	Total dust.	TWA	15 mg/m ³		N/A	OSHA Z1
PENTAERYTHRITOL		TWA	10 mg/m ³		N/A	ACGIH

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:

No special requirements under ordinary conditions of use and with adequate ventilation.

Product Name: MOBILTEMP SHC 32

Revision Date: 01Dec2005

Page 4 of 8

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

No protection is ordinarily required under normal conditions of use and with adequate ventilation.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapor warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Work conditions can greatly effect glove durability; inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:

No protection is ordinarily required under normal conditions of use.

Eye Protection: If contact is likely, safety glasses with side shields are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:

No skin protection is ordinarily required under normal conditions of use. In accordance with good industrial hygiene practices, precautions should be taken to avoid skin contact.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping.

ENVIRONMENTAL CONTROLS

See Sections 6, 7, 12, 13.

SECTION 9

PHYSICAL AND CHEMICAL PROPERTIES

Typical physical and chemical properties are given below. Consult the Supplier in Section 1 for additional data.

GENERAL INFORMATION

Physical State: Solid

Form: Semi-fluid

Color: Red

Odor: Characteristic

Odor Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15 °C): 0.952

Product Name: MOBILTEMP SHC 32

Revision Date: 01Dec2005

Page 5 of 8

Flash Point [Method]: >204°C (400°F) [EST. FOR OIL, ASTM D-92 (COC)]

Flammable Limits (Approximate volume % in air): LEL: N/D UEL: N/D

Autoignition Temperature: N/D

Boiling Point / Range: > 316°C (600°F)

Vapor Density (Air = 1): N/D

Vapor Pressure: < 0.013 kPa (0.1 mm Hg) at 20°C

Evaporation Rate (n-butyl acetate = 1): N/D

pH: N/A

Log Pow (n-Octanol/Water Partition Coefficient): > 3.5

Solubility in Water: Negligible

Viscosity: 29.2 cSt (29.2 mm²/sec) at 40 °C

Oxidizing Properties: See Sections 3, 15, 16.

OTHER INFORMATION

Freezing Point: N/D

Melting Point: N/D

NOTE: Most physical properties above are for the oil component in the material.

SECTION 10	STABILITY AND REACTIVITY
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STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Excessive heat. High energy sources of ignition.

MATERIALS TO AVOID: Strong oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

HAZARDOUS POLYMERIZATION: Will not occur.

SECTION 11	TOXICOLOGICAL INFORMATION
-------------------	----------------------------------

ACUTE TOXICITY

<u>Route of Exposure</u>	<u>Conclusion / Remarks</u>
Inhalation	
Toxicity (Rat): LC50 > 5000 mg/m ³	Minimally Toxic. Based on assessment of the components.
Irritation: No end point data.	Negligible hazard at ambient/normal handling temperatures. Based on assessment of the components.
Ingestion	
Toxicity (Rat): LD50 > 2000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Skin	
Toxicity (Rabbit): LD50 > 2000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Irritation (Rabbit): Data available.	Negligible irritation to skin at ambient temperatures. Based on assessment of the components.
Eye	
Irritation (Rabbit): Data available.	May cause mild, short-lasting discomfort to eyes. Based on

Product Name: MOBILTEMP SHC 32

Revision Date: 01Dec2005

Page 6 of 8

assessment of the components.

CHRONIC/OTHER EFFECTS

Contains:

Synthetic base oils: Not expected to cause significant health effects under conditions of normal use, based on laboratory studies with the same or similar materials. Not mutagenic or genotoxic. Not sensitizing in test animals and humans.

Phenyl-alpha-naphthylamine (PAN): Undiluted PAN is a skin sensitizer. Human testing with lubricants containing 1.0% PAN caused no reactions indicative of sensitization.

Additional information is available by request.

The following ingredients are cited on the lists below: None.

--REGULATORY LISTS SEARCHED--

1 = NTP CARC

3 = IARC 1

5 = IARC 2B

2 = NTP SUS

4 = IARC 2A

6 = OSHA CARC

SECTION 12

ECOLOGICAL INFORMATION

The information given is based on data available for the material, the components of the material, and similar materials.

ECOTOXICITY

Material -- Expected to be harmful to aquatic organisms. May cause long-term adverse effects in the aquatic environment.

MOBILITY

Base oil component -- Low solubility and floats and is expected to migrate from water to the land. Expected to partition to sediment and wastewater solids.

PERSISTENCE AND DEGRADABILITY

Biodegradation:

Base oil component -- Expected to be inherently biodegradable

BIOACCUMULATION POTENTIAL

Base oil component -- Has the potential to bioaccumulate, however metabolism or physical properties may reduce the bioconcentration or limit bioavailability.

SECTION 13

DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Suitable routes of disposal are supervised incineration, preferentially with energy recovery, or appropriate

Product Name: MOBILTEMP SHC 32

Revision Date: 01Dec2005

Page 7 of 8

recycling methods in accordance with applicable regulations and material characteristics at the time of disposal.

REGULATORY DISPOSAL INFORMATION

RCRA Information: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed as hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrosivity or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

Empty Container Warning PRECAUTIONARY LABEL TEXT: Empty containers may retain residue and can be dangerous. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION; THEY MAY EXPLODE AND CAUSE INJURY OR DEATH. Do not attempt to refill or clean container since residue is difficult to remove. Empty drums should be completely drained, properly bunged and promptly returned to a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations.

SECTION 14

TRANSPORT INFORMATION

LAND (DOT) : Not Regulated for Land Transport

LAND (TDG) : Not Regulated for Land Transport

SEA (IMDG) : Not Regulated for Sea Transport according to IMDG-Code

AIR (IATA) : Not Regulated for Air Transport

SECTION 15

REGULATORY INFORMATION

OSHA HAZARD COMMUNICATION STANDARD: When used for its intended purposes, this material is not classified as hazardous in accordance with OSHA 29 CFR 1910.1200.

NATIONAL CHEMICAL INVENTORY LISTING: AICS, EINECS, TSCA

EPCRA: This material contains no extremely hazardous substances.

SARA (311/312) REPORTABLE HAZARD CATEGORIES: None.

SARA (313) TOXIC RELEASE INVENTORY: This material contains no chemicals subject to the supplier notification requirements of the SARA 313 Toxic Release Program.

The Following Ingredients are Cited on the Lists Below:*

Chemical Name	CAS Number	List Citations
DIPHENYLAMINE	122-39-4	5, 9
PENTAERYTHRITOL	115-77-5	1, 4, 13, 16, 19

Product Name: MOBILTEMP SHC 32

Revision Date: 01Dec2005

Page 8 of 8

--REGULATORY LISTS SEARCHED--

1 = ACGIH ALL	6 = TSCA 5a2	11 = CA P65 REPRO	16 = MN RTK
2 = ACGIH A1	7 = TSCA 5e	12 = CA RTK	17 = NJ RTK
3 = ACGIH A2	8 = TSCA 6	13 = IL RTK	18 = PA RTK
4 = OSHA Z	9 = TSCA 12b	14 = LA RTK	19 = RI RTK
5 = TSCA 4	10 = CA P65 CARC	15 = MI 293	

Code key: CARC=Carcinogen; REPRO=Reproductive

* EPA recently added new chemical substances to its TSCA Section 4 test rules. Please contact the supplier to confirm whether the ingredients in this product currently appear on a TSCA 4 or TSCA 12b list.

SECTION 16

OTHER INFORMATION

N/D = Not determined, N/A = Not applicable

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:

No revision information is available.

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MHC: 0, 0, 0, 0, 0, 0

PPEC: A

DGN: 2009817XUS (555181)

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MATERIAL SAFETY DATA SHEET**Product Trade Name:** HOLEPLUG® 3/8**Revision Date:** 03-Jan-2008**1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION****Product Trade Name:** HOLEPLUG® 3/8
Synonyms: None
Chemical Family: Mineral
Application: Fluid Loss Additive**Manufacturer/Supplier** Baroid Fluid Services
Product Service Line of Halliburton
P.O. Box 1675
Houston, TX 77251
Telephone: (281) 871-4000
Emergency Telephone: (281) 575-5000**Prepared By** Chemical Compliance
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com**2. COMPOSITION/INFORMATION ON INGREDIENTS**

SUBSTANCE	CAS Number	PERCENT	ACGIH TLV-TWA	OSHA PEL-TWA
Crystalline silica, cristobalite	14464-46-1	0 - 1%	0.025 mg/m ³	1/2 x 10 mg/m ³ %SiO ₂ + 2
Crystalline silica, tridymite	15468-32-3	0 - 1%	0.05 mg/m ³	1/2 x 10 mg/m ³ %SiO ₂ + 2
Crystalline silica, quartz	14808-60-7	0 - 5%	0.025 mg/m ³	10 mg/m ³ %SiO ₂ + 2
Bentonite	1302-78-9	60 - 100%	Not applicable	Not applicable

More restrictive exposure limits may be enforced by some states, agencies, or other authorities.

3. HAZARDS IDENTIFICATION

Hazard Overview

CAUTION! - ACUTE HEALTH HAZARD

May cause eye and respiratory irritation.

DANGER! - CHRONIC HEALTH HAZARD

Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposures below recommended exposure limits. Wear a NIOSH certified, European Standard EN 149, or equivalent respirator when using this product. Review the Material Safety Data Sheet (MSDS) for this product, which has been provided to your employer.

4. FIRST AID MEASURES

Inhalation

If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Skin

Wash with soap and water. Get medical attention if irritation persists.

Eyes

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Ingestion

Under normal conditions, first aid procedures are not required.

Notes to Physician

Treat symptomatically.

5. FIRE FIGHTING MEASURES

Flash Point/Range (F):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (F):	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined

Fire Extinguishing Media All standard firefighting media.

Special Exposure Hazards Not applicable.

Special Protective Equipment for Fire-Fighters Not applicable.

NFPA Ratings: Health 0, Flammability 0, Reactivity 0
HMS Ratings: Flammability 0, Reactivity 0, Health 0*

6. ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures Use appropriate protective equipment. Avoid creating and breathing dust.

Environmental Precautionary Measures None known.

Procedure for Cleaning / Absorption

Collect using dustless method and hold for appropriate disposal. Consider possible toxic or fire hazards associated with contaminating substances and use appropriate methods for collection, storage and disposal.

7. HANDLING AND STORAGE

Handling Precautions

This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH certified, European Standard En 149, or equivalent respirator when using this product. Material is slippery when wet.

Storage Information

Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container. Product has a shelf life of 12 months.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits listed in Section 2.

Respiratory Protection

Wear a NIOSH certified, European Standard EN 149, or equivalent respirator when using this product.

Hand Protection

Normal work gloves.

Skin Protection

Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.

Eye Protection

Wear safety glasses or goggles to protect against exposure.

Other Precautions

None known.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid
Color:	Various
Odor:	Odorless
pH:	7.5
Specific Gravity @ 20 C (Water=1):	2.12
Density @ 20 C (lbs./gallon):	Not Determined
Bulk Density @ 20 C (lbs/ft3):	51
Boiling Point/Range (F):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (F):	Not Determined
Freezing Point/Range (C):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Insoluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (lbs./gallon):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid	None anticipated
Incompatibility (Materials to Avoid)	Hydrofluoric acid.
Hazardous Decomposition Products	Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye or skin contact, inhalation.
Inhalation	<p>Inhaled crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (IARC, Group 1). There is sufficient evidence in experimental animals for the carcinogenicity of tridymite (IARC, Group 2A).</p> <p>Breathing silica dust may cause irritation of the nose, throat, and respiratory passages. Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may also have serious chronic health effects (See "Chronic Effects/Carcinogenicity" subsection below).</p>
Skin Contact	May cause mechanical skin irritation.
Eye Contact	May cause eye irritation.
Ingestion	None known
Aggravated Medical Conditions	Individuals with respiratory disease, including but not limited to asthma and bronchitis, or subject to eye irritation, should not be exposed to quartz dust.

Chronic Effects/Carcinogenicity Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis.

Cancer Status: The International Agency for Research on Cancer (IARC) has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources can cause lung cancer in humans (Group 1 - carcinogenic to humans) and has determined that there is sufficient evidence in experimental animals for the carcinogenicity of tridymite (Group 2A - possible carcinogen to humans). Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997) in conjunction with the use of these minerals. The National Toxicology Program classifies respirable crystalline silica as "Known to be a human carcinogen". Refer to the 9th Report on Carcinogens (2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2).

There is some evidence that breathing respirable crystalline silica or the disease silicosis is associated with an increased incidence of significant disease endpoints such as scleroderma (an immune system disorder manifested by scarring of the lungs, skin, and other internal organs) and kidney disease.

Other Information For further information consult "Adverse Effects of Crystalline Silica Exposure" published by the American Thoracic Society Medical Section of the American Lung Association, American Journal of Respiratory and Critical Care Medicine, Volume 155, pages 761-768 (1997).

Toxicity Tests

Oral Toxicity:	Not determined
Dermal Toxicity:	Not determined
Inhalation Toxicity:	Not determined
Primary Irritation Effect:	Not determined
Carcinogenicity	Refer to <u>IARC Monograph 68, Silica, Some Silicates and Organic Fibres</u> (June 1997).
Genotoxicity:	Not determined
Reproductive / Developmental Toxicity:	Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air)	Not determined
Persistence/Degradability	Not determined
Bio-accumulation	Not Determined

Ecotoxicological Information

Acute Fish Toxicity:	Not determined
Acute Crustaceans Toxicity:	Not determined

Acute Algae Toxicity:	Not determined
Chemical Fate Information	Not determined
Other Information	Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method	Bury in a licensed landfill according to federal, state, and local regulations.
Contaminated Packaging	Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

DOT
Not restricted

Canadian TDG
Not restricted

ADR Not restricted

Air Transportation

ICAO/IATA Not restricted

Sea Transportation

IMDG Not restricted

Other Shipping Information

Labels: None

15. REGULATORY INFORMATION

US Regulations

US TSCA Inventory	All components listed on inventory.
EPA SARA Title III Extremely Hazardous Substances	Not applicable
EPA SARA (311,312) Hazard Class	Acute Health Hazard Chronic Health Hazard
EPA SARA (313) Chemicals	This product does not contain a toxic chemical for routine annual "Toxic Chemical Release Reporting" under Section 313 (40 CFR 372).
EPA CERCLA/Superfund Reportable Spill Quantity	Not applicable.
EPA RCRA Hazardous Waste Classification	If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.
California Proposition 65	The California Proposition 65 regulations apply to this product.

MA Right-to-Know Law	One or more components listed.
NJ Right-to-Know Law	One or more components listed.
PA Right-to-Know Law	One or more components listed.
Canadian Regulations	
Canadian DSL Inventory	All components listed on inventory.
WHMIS Hazard Class	D2A Very Toxic Materials Crystalline silica

16. OTHER INFORMATION

The following sections have been revised since the last issue of this MSDS

Not applicable

Additional Information

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Material Safety Data Sheet for this or other Halliburton products, contact Chemical Compliance at 1-580-251-4335.

Disclaimer Statement

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

*****END OF MSDS*****

MATERIAL SAFETY DATA SHEET**Product Trade Name:** HOLEPLUG® 3/4**Revision Date:** 03-Jan-2008**1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION**

Product Trade Name: HOLEPLUG® 3/4
Synonyms: None
Chemical Family: Mineral
Application: Fluid Loss Additive

Manufacturer/Supplier Baroid Fluid Services
Product Service Line of Halliburton
P.O. Box 1675
Houston, TX 77251
Telephone: (281) 871-4000
Emergency Telephone: (281) 575-5000

Prepared By Chemical Compliance
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

SUBSTANCE	CAS Number	PERCENT	ACGIH TLV-TWA	OSHA PEL-TWA
Crystalline silica, cristobalite	14464-46-1	0 - 1%	0.025 mg/m ³	1/2 x 10 mg/m ³ %SiO ₂ + 2
Crystalline silica, tridymite	15468-32-3	0 - 1%	0.05 mg/m ³	1/2 x 10 mg/m ³ %SiO ₂ + 2
Crystalline silica, quartz	14808-60-7	1 - 5%	0.025 mg/m ³	10 mg/m ³ %SiO ₂ + 2
Bentonite	1302-78-9	60 - 100%	Not applicable	Not applicable

More restrictive exposure limits may be enforced by some states, agencies, or other authorities.

3. HAZARDS IDENTIFICATION

Hazard Overview

CAUTION! - ACUTE HEALTH HAZARD

May cause eye and respiratory irritation.

DANGER! - CHRONIC HEALTH HAZARD

Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposures below recommended exposure limits. Wear a NIOSH certified, European Standard EN 149, or equivalent respirator when using this product. Review the Material Safety Data Sheet (MSDS) for this product, which has been provided to your employer.

4. FIRST AID MEASURES

Inhalation

If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Skin

Wash with soap and water. Get medical attention if irritation persists.

Eyes

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Ingestion

Under normal conditions, first aid procedures are not required.

Notes to Physician

Treat symptomatically.

5. FIRE FIGHTING MEASURES

Flash Point/Range (F):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (F):	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined

Fire Extinguishing Media All standard firefighting media.

Special Exposure Hazards Not applicable.

Special Protective Equipment for Fire-Fighters Not applicable.

NFPA Ratings: Health 0, Flammability 0, Reactivity 0
HMS Ratings: Flammability 0, Reactivity 0, Health 0*

6. ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures Use appropriate protective equipment. Avoid creating and breathing dust.

Environmental Precautionary Measures None known.

Procedure for Cleaning / Absorption

Collect using dustless method and hold for appropriate disposal. Consider possible toxic or fire hazards associated with contaminating substances and use appropriate methods for collection, storage and disposal.

7. HANDLING AND STORAGE

Handling Precautions

This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH certified, European Standard En 149, or equivalent respirator when using this product. Material is slippery when wet.

Storage Information

Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container. Product has a shelf life of 36 months.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits listed in Section 2.

Respiratory Protection

Wear a NIOSH certified, European Standard EN 149, or equivalent respirator when using this product.

Hand Protection

Normal work gloves.

Skin Protection

Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.

Eye Protection

Wear safety glasses or goggles to protect against exposure.

Other Precautions

None known.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid
Color:	Tan to Gray
Odor:	Mild earthy
pH:	7.5
Specific Gravity @ 20 C (Water=1):	2.12
Density @ 20 C (lbs./gallon):	Not Determined
Bulk Density @ 20 C (lbs/ft3):	51- 60
Boiling Point/Range (F):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (F):	Not Determined
Freezing Point/Range (C):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Insoluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (lbs./gallon):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistrokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid	None anticipated
Incompatibility (Materials to Avoid)	Hydrofluoric acid.
Hazardous Decomposition Products	Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye or skin contact, inhalation.
Inhalation	<p>Inhaled crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (IARC, Group 1). There is sufficient evidence in experimental animals for the carcinogenicity of tridymite (IARC, Group 2A).</p> <p>Breathing silica dust may cause irritation of the nose, throat, and respiratory passages. Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may also have serious chronic health effects (See "Chronic Effects/Carcinogenicity" subsection below).</p>
Skin Contact	May cause mechanical skin irritation.
Eye Contact	May cause eye irritation.
Ingestion	None known
Aggravated Medical Conditions	Individuals with respiratory disease, including but not limited to asthma and bronchitis, or subject to eye irritation, should not be exposed to quartz dust.

Chronic Effects/Carcinogenicity Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis.

Cancer Status: The International Agency for Research on Cancer (IARC) has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources can cause lung cancer in humans (Group 1 - carcinogenic to humans) and has determined that there is sufficient evidence in experimental animals for the carcinogenicity of tridymite (Group 2A - possible carcinogen to humans). Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997) in conjunction with the use of these minerals. The National Toxicology Program classifies respirable crystalline silica as "Known to be a human carcinogen". Refer to the 9th Report on Carcinogens (2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2).

There is some evidence that breathing respirable crystalline silica or the disease silicosis is associated with an increased incidence of significant disease endpoints such as scleroderma (an immune system disorder manifested by scarring of the lungs, skin, and other internal organs) and kidney disease.

Other Information For further information consult "Adverse Effects of Crystalline Silica Exposure" published by the American Thoracic Society Medical Section of the American Lung Association, American Journal of Respiratory and Critical Care Medicine, Volume 155, pages 761-768 (1997).

Toxicity Tests

Oral Toxicity:	Not determined
Dermal Toxicity:	Not determined
Inhalation Toxicity:	Not determined
Primary Irritation Effect:	Not determined
Carcinogenicity	Refer to <u>IARC Monograph 68, Silica, Some Silicates and Organic Fibres</u> (June 1997).
Genotoxicity:	Not determined
Reproductive / Developmental Toxicity:	Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air)	Not determined
Persistence/Degradability	Not determined
Bio-accumulation	Not Determined

Ecotoxicological Information

Acute Fish Toxicity:	Not determined
Acute Crustaceans Toxicity:	Not determined

Acute Algae Toxicity:	Not determined
Chemical Fate Information	Not determined
Other Information	Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method	Bury in a licensed landfill according to federal, state, and local regulations.
Contaminated Packaging	Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

DOT
Not restricted

Canadian TDG
Not restricted

ADR Not restricted

Air Transportation

ICAO/IATA Not restricted

Sea Transportation

IMDG Not restricted

Other Shipping Information

Labels: None

15. REGULATORY INFORMATION

US Regulations

US TSCA Inventory All components listed on inventory.

EPA SARA Title III Extremely Hazardous Substances Not applicable

EPA SARA (311,312) Hazard Class Acute Health Hazard
Chronic Health Hazard

EPA SARA (313) Chemicals This product does not contain a toxic chemical for routine annual "Toxic Chemical Release Reporting" under Section 313 (40 CFR 372).

EPA CERCLA/Superfund Reportable Spill Quantity Not applicable.

EPA RCRA Hazardous Waste Classification If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.

California Proposition 65 The California Proposition 65 regulations apply to this product.

MA Right-to-Know Law	One or more components listed.
NJ Right-to-Know Law	One or more components listed.
PA Right-to-Know Law	One or more components listed.
Canadian Regulations	
Canadian DSL Inventory	All components listed on inventory.
WHMIS Hazard Class	D2A Very Toxic Materials Crystalline silica

16. OTHER INFORMATION

The following sections have been revised since the last issue of this MSDS

Not applicable

Additional Information

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Material Safety Data Sheet for this or other Halliburton products, contact Chemical Compliance at 1-580-251-4335.

Disclaimer Statement

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

*****END OF MSDS*****



CAMEO Chemicals

 [Print](#)

Chemical Datasheet

KEROSENE

2
2 0

Chemical Identifiers

UN/NA Number	CAS Number	CHRIS Code	DOT Hazard Label
1223	8008-20-6	KRS	FLAMMABLE LIQUID

NFPA 704: Red 2 -- Flammability: Ignites when moderately heated
Blue 2 -- Health Hazard: Hazardous - use breathing apparatus
Yellow 0 -- Reactivity: Normally stable

General Description

A clear colorless to light amber liquid with a petroleum odor. Flash point 100°F. Less dense than water and insoluble in water. Vapors are heavier than air.

Hazards

Reactivity Alerts

 Highly Flammable

Air & Water Reactions

Highly flammable. Insoluble in water.

Fire Hazard

HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks). Vapor explosion hazard indoors, outdoors or in sewers. Runoff to sewer may create fire or explosion hazard. Containers may explode when heated. Many liquids are lighter than water. Substance may be transported hot. If molten aluminum is involved, refer to GUIDE 169 below.

GUIDE 169: Substance is transported in molten form at a temperature above 705° C (1300° F). Violent reaction with water; contact may cause an explosion or may produce a flammable gas. Will ignite combustible materials (wood, paper, oil, debris, etc.). Contact with nitrates or other oxidizers may cause an explosion. Contact with containers or other materials, including cold, wet or dirty tools, may cause an explosion. Contact with concrete will cause spalling and small pops. (ERG, 2008)

Health Hazard

Vapor causes slight irritation of eyes and nose. Liquid irritates stomach; if taken into lungs, causes coughing, distress, and rapidly developing pulmonary edema. (USCG, 1999)

Reactivity Profile

Saturated aliphatic hydrocarbons, contained in KEROSENE, may be incompatible with strong oxidizing agents like nitric acid. Charring of the hydrocarbon may occur followed by ignition of unreacted hydrocarbon and other nearby combustibles. In other settings, aliphatic saturated hydrocarbons are mostly unreactive. They are not affected by aqueous solutions of acids, alkalis, most oxidizing agents, and most reducing agents.

Belongs to the Following Reactive Group(s)

- Hydrocarbons, Aliphatic Saturated

Response Recommendations

Firefighting

Do not extinguish fire unless flow can be stopped. Use water in flooding quantities as fog. Solid streams of water may spread fire. Cool all affected containers with flooding quantities of water. Apply water from as far a distance as possible. Use foam, dry chemical, or carbon dioxide. (AAR, 2003)

Non-Fire Response

Keep sparks, flames, and other sources of ignition away. Keep material out of water sources and sewers. Build dikes to contain flow as necessary. Use water spray to knock-down vapors. (AAR, 2003)

Protective Clothing

Skin: Wear appropriate personal protective clothing to prevent skin contact.

Eyes: Wear appropriate eye protection to prevent eye contact.

Wash skin: The worker should immediately wash the skin when it becomes contaminated.

Remove: Work clothing that becomes wet or significantly contaminated should be removed and replaced.

Change: No recommendation is made specifying the need for the worker to change clothing after the work shift.

Provide: Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility of exposure. [Note: It is intended that these facilities provide a sufficient quantity or flow of water to quickly remove the substance from any body areas likely to be exposed. The actual determination of what constitutes an adequate quick drench facility depends on the specific circumstances. In certain instances, a deluge shower should be readily available, whereas in others, the availability of water from a sink or hose could be considered adequate.] (NIOSH, 2003)

First Aid

EYES: First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center. Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician.

IMMEDIATELY transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) develop.

SKIN: IMMEDIATELY flood affected skin with water while removing and isolating all contaminated clothing.

Gently wash all affected skin areas thoroughly with soap and water. IMMEDIATELY call a hospital or poison control center even if no symptoms (such as redness or irritation) develop. IMMEDIATELY transport the victim to a hospital for treatment after washing the affected areas.

INHALATION: IMMEDIATELY leave the contaminated area; take deep breaths of fresh air. IMMEDIATELY call a physician and be prepared to transport the victim to a hospital even if no symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop. Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Protective Clothing.

INGESTION: DO NOT INDUCE VOMITING. If the victim is conscious and not convulsing, give 1 or 2 glasses of water to dilute the chemical and IMMEDIATELY call a hospital or poison control center. Be prepared to transport the victim to a hospital if advised by a physician. If the victim is convulsing or unconscious, do not give anything by mouth, ensure that the victim's airway is open and lay the victim on his/her side with the head lower than the body. DO NOT INDUCE VOMITING. IMMEDIATELY transport the victim to a hospital.

OTHER: Since this chemical is a known or suspected carcinogen you should contact a physician for advice regarding the possible long term health effects and potential recommendation for medical monitoring. Recommendations from the physician will depend upon the specific compound, its chemical, physical and toxicity properties, the exposure level, length of exposure, and the route of exposure. (NTP, 1992)

Physical Properties

Molecular Formula: data unavailable

Flash Point: 95-145 ° F (NTP, 1992)

Lower Explosive Limit: 0.6 % (NTP, 1992)

Upper Explosive Limit: 4.9 % (NTP, 1992)

Autoignition Temperature: 444.0 ° F (USCG, 1999)

Melting Point: <-54.4 ° F (NTP, 1992)

Vapor Pressure: 0.1 mm Hg at 100.0 ° F psi (NTP, 1992)

Vapor Density: 4.5 (NTP, 1992)

Specific Gravity: 0.8 at 59.0 ° F (USCG, 1999)

Boiling Point: 338-617 ° F at 760 mm Hg (NTP, 1992)

Molecular Weight: 170.0 (approx) (NIOSH, 2003)

Water Solubility: Insoluble (NTP, 1992)

AEGL: data unavailable

ERPG: data unavailable

TEEL-1

290.0 mg/m³
(SCAPA, 2008)

TEEL-2

1100.0 mg/m³

TEEL-3

1100.0 mg/m³

IDLH: data unavailable

Regulatory Information

Regulatory Names: none

CAA RMP: Not a regulated chemical.

CERCLA: Not a regulated chemical.

EHS (EPCRA 302): Not a regulated chemical.

TRI (EPCRA 313): Not a regulated chemical.

RCRA Chemical Code: none

Alternate Chemical Names

- AF 100 (PESTICIDE)
- AVTUR
- AVTUR (PESTICIDE)
- BAYOL 35
- BITUMEN CUTTER
- COAL OIL
- ESCAID 100
- ESCAID 110
- EXXSOL D 200/240
- FUEL OIL NO. 1
- FUEL OIL, NO.5
- FUELS, KEROSENE
- ILLUMINATING OIL
- INK OIL
- JET FUEL: JP-1
- KEROSENO (DOT SPANISH)
- KEROSENE
- KEROSENE {FUEL OIL #1}
- KO 30 (SOLVENT)
- KÉROSÈNE (DOT FRENCH)
- NCI-C54784
- NEOCHIOZOL
- NYSOLVIN 75A
- ODORLESS SOLVENT 3440
- PEGASOL 3040
- PETROLEUM FUEL
- RANGE OIL
- RESIDUAL OIL NO.5
- SHELL 140
- SHELLSOL 2046
- SX 12
- SX 7



Material Safety Data Sheet

The information presented in these forms is believed to be correct and sufficient to meet the requirements of OSHA Hazard Communication standard (29 CFR 1910.1200) concerning worker's right to know.

The following material safety data sheet covers the hazardous ingredients associated with more than one color aerosol product. As per 29 CFR 1900.1200 paragraph (g); whenever the hazards associated with similar mixtures are the same, then one MSDS may be prepared to cover several products.

This MSDS covers the following Aerove aerosol products.

PRODUCT NAME: All Purpose Marking Paint

Non-Fluorescent Colors

- 1380 Black
- 1381 Red
- 1382 Yellow
- 1383 Blue
- 1384 Green
- 1385 Orange
- 1387 White

Fluorescent Colors

- 1390 Red
- 1391 Green
- 1392 Orange
- 1393 Yellow
- 1394 Blue
- 1395 Red-Orange
- 1399 Pink

SECTION I - MANUFACTURER IDENTIFICATION

MANUFACTURER'S NAME: Aerove Industries, Inc.
INFORMATION PHONE: 775-782-0100
DATE REVISED: April 4, 2008

ADDRESS: 1198 Mark Circle, Gardnerville, NV 89410
EMERGENCY PHONE: 1-800-424-9300
REASON REVISED: Updated

**SECTION II - HAZARDOUS INGREDIENTS / SARA III INFORMATION
 OCCUPATIONAL EXPOSURE LIMITS**

HAZARDOUS COMPONENTS	WEIGHT PERCENT	OSHA PEL	ACGIH TLV	LD50 SPECIES & ROUTE	LC50 SPECIES & ROUTE
Hydrocarbon Propellant (CAS 68476-86-8)	10 - 30	1000 ppm	1000 ppm	N / AV	N / AV
Aliphatic Petroleum Distillates (CAS 64742-89-8)	7 - 13	N / AV	300 ppm	N / AV	N / AV
*Hexane (CAS 110-54-3)	1 - 5	500 ppm	50 ppm (skin)	2870 mg / kg (Rat-Oral)	N / AV
Aliphatic Petroleum Distillates (CAS 64742-88-7)	1 - 5	100 ppm	100 ppm	N / AV	N / AV

Non-Fluorescent Colors Also Contain:

*Hexane (CAS 110-54-3)	7 - 13	500 ppm	50 ppm (skin)	2870 mg / kg (Rat-Oral)	N / AV
Acetone (CAS 67-64-1)	1 - 5	1000 ppm	500 ppm	5800 mg / kg (Rat-Oral)	21000 ppm / 8 hr (Rat-Inha)

*Indicates toxic chemical(s) subject to the reporting requirements of section 313 of Title III and of 40 CFR 372.

NOTE: N / AP = Not Applicable N / AV = Not Available

SECTION III - PHYSICAL / CHEMICAL CHARACTERISTICS

BOILING POINT: N / AP
VAPOR DENSITY: Heavier than air
EVAPORATION RATE: Faster than n-Butyl Acetate

SPECIFIC GRAVITY (H2O=1): 0.9
SOLUBILITY IN WATER: Partial
APPEARANCE AND ODOR: Opaque liquid with hydrocarbon odor.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: < 0° F (-18° C)
EXTINGUISHING MEDIA: Carbon dioxide, dry chemical, water spray.
SPECIAL FIRE FIGHTING PROCEDURES: Use water spray to cool containers exposed to heat or fire to prevent pressure build up. Self-contained breathing apparatus should be used if product is involved in fire.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Treat as cylinders of compressed gas. Closed containers may rupture due to pressure build up from extreme temperature.
FLAMMABILITY: Yes - Flammable aerosol under conditions of sparks, flame, or hot surfaces.
SENSITIVITY TO IMPACT: Do not puncture
METHOD USED: Estimated
FLAMMABLE LIMITS - LEL: 0.9% **UEL:** 13.0%
SENSITIVITY TO STATIC DISCHARGE: Primarily vapors

SECTION V - REACTIVITY DATA

STABILITY: Stable
INCOMPATIBILITY (MATERIALS TO AVOID): Strong oxidizing agents.
HAZARDOUS DECOMPOSITION OR BY-PRODUCTS: Carbon Monoxide, Carbon Dioxide.
HAZARDOUS POLYMERIZATION: Will not occur
CONDITIONS TO AVOID: Open flames, sparks, electrical arcs.

SECTION VI - HEALTH HAZARD DATA

INHALATION: Respiratory tract irritant. May cause dizziness, light-headedness and / or headaches. Intentional misuse by deliberately concentrating and inhaling the contents may be harmful or fatal.
SKIN CONTACT: Prolonged or repeated contact may cause irritation and dermatitis.
EYE CONTACT: Painful with slight to moderate irritation.
INGESTION: May be harmful or fatal if swallowed
EFFECTS OF CHRONIC OVEREXPOSURE: Reports have associated repeated and prolonged overexposure to solvents with permanent brain and nervous system damage. Repeated overexposure can also damage kidneys, lungs, liver, heart and blood.
CARCINOGENICITY: The ingredients are not listed as a human carcinogen by IARC, ACGIH, NTP, or OSHA.
TERATOGENICITY: Not established **MUTAGENICITY:** Not established
MEDICAL CONDITION GENERALLY AGGRAVATED BY EXPOSURE: Not established
EMERGENCY AND FIRST AID PROCEDURES: INHALATION - Remove from exposure, seek medical attention if signs/symptoms persist.
 SKIN - Wash affected area with soap and water, remove contaminated clothing, seek medical attention if irritation persists.
 EYES - Flush immediately with water for 15 minutes, seek medical attention if irritation persists.
 INGESTION - Do not induce vomiting. Contact physician or poison control center immediately.

SECTION VII - PRECAUTIONS FOR SAFE HANDLING AND USE

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Remove all sources of ignition. Ventilate area. Prevent from entering a watercourse. Use an inert absorbent material and non-sparking type tools.
WASTE DISPOSAL METHOD: Dispose of in accordance with local, state and federal regulations. Do not incinerate closed containers.
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: Do not store above 120° F (49° C). Do not store or use near heat, sparks or flame.
OTHER PRECAUTIONS: Avoid contact with eyes and skin. Do not breathe vapors, take internally or smoke while using this product.

SECTION VIII - CONTROL MEASURES

RESPIRATORY PROTECTION: In areas with poor ventilation, use a NIOSH approved Organic Vapor Cartridge Respirator. For concentrations above the TLV (as defined in Section II), use a positive air supplied respirator.
VENTILATION: General ventilation to maintain exposure limits below TLV's as defined in Section II.
PROTECTIVE GLOVES: Chemical resistant gloves such as Neoprene or Nitrile rubber.
EYE PROTECTION: Safety glasses or goggles.
OTHER PROTECTIVE CLOTHING OR EQUIPMENT: Not established.
WORK / HYGIENIC PRACTICES: Avoid prolonged or repeated contact. Do not breathe vapors. Wash contaminated clothing prior to reuse.

SECTION IX - DISCLAIMER

THE INFORMATION CONTAINED HEREIN IS BELIEVED TO BE ACCURATE BUT IS NOT WARRANTED TO BE SO. NOTHING CONTAINED HEREIN CONSTITUTES A SPECIFICATION NOR IS IT INTENDED TO WARRANT SUITABILITY FOR THE INTENDED USE.



Material Safety Data Sheet

Tree Marking Paint (aerosol) August 08, 2008

19A1

The following material safety data sheet covers the hazardous ingredients associated with more than one color aerosol product. As per 29 CFR 1900. 1200 paragraph (g); whenever the hazards associated with similar mixtures are the same, then one MSDS may be prepared to cover several products.

This MSDS covers the following Aervoe aerosol products.

TREE MARKING PAINT

NON-FLUORESCENT COLORS

610 Red
620 Orange
630 Yellow

640 Green
645 Dark Green
650 Blue

660 Black
670 White

FLUORESCENT COLORS

688 Green
690 Red
691 Pink

692 Orange
693 Yellow

SECTION I - MANUFACTURER IDENTIFICATION

MANUFACTURER'S NAME: Aervoe Industries Inc.
INFORMATION PHONE: 775-782-0100
DATE REVISED: August 08, 2007

ADDRESS: 1198 Mark Circle, Gardnerville, NV 89410
EMERGENCY PHONE: 1-800-424-9300
REASON REVISED: Updated

SECTION II - HAZARDOUS INGREDIENTS / SARA III INFORMATION OCCUPATIONAL EXPOSURE LIMITS

HAZARDOUS COMPONENTS	WEIGHT PERCENT	OSHA PEL	ACGIH TLV	LD50 SPECIES & ROUTE	LC50 SPECIES & ROUTE
Petroleum Naphtha (CAS 64742-89-8)	10 - 30	N / AV	N / AV	> 2.84 g / kg (Rat-Dermal)	N / AV
Hydrocarbon Propellant (CAS 68476-86-8)	10 - 30	1000 ppm	1000 ppm	N / AV	N / AV
Non-Fluorescent colors also contain:					
Aliphatic Hydrocarbon (CAS 8052-41-3)	10 - 30	500 ppm	100 ppm	N / AV	N / AV
Petroleum Naphtha (CAS 64742-89-8)	10 - 30	N / AV	N / AV	> 2.84 g / kg (Rat-Dermal)	N / AV
Fluorescent colors also contain:					
*Hexane (CAS 110-54-3)	7 - 13	500 ppm	50 ppm (skin)	2870 mg / kg (Rat-Oral)	N / AV
Aliphatic Petroleum Distillates (CAS 64742-88-7)	1 - 5	100 ppm	100 ppm	N / AV	N / AV
Aromatic Hydrocarbons (CAS 64742-94-5)		10 ppm	10 ppm	N / AV	N / AV

*Indicates toxic chemical(s) subject to the reporting requirements of section 313 of Title III and of 40 CFR 372.

NOTE: N / AP = Not Applicable N / AV = Not Available

SECTION III - PHYSICAL / CHEMICAL CHARACTERISTICS

BOILING POINT: N / AP
VAPOR DENSITY: Heavier than air
EVAPORATION RATE: Faster than n-Butyl Acetate

SPECIFIC GRAVITY (H20=1): 0.8 to 0.9
SOLUBILITY IN WATER: Negligible
APPEARANCE AND ODOR: Opaque liquid with hydrocarbon odor.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: < 0° F (-18° C) **METHOD USED:** Estimated **FLAMMABLE LIMITS IN AIR BY VOLUME - LOWER:** 0.7% **UPPER:** 9.5%

EXTINGUISHING MEDIA: Carbon Dioxide, Dry Chemical, Water Spray

SPECIAL FIRE FIGHTING PROCEDURES: Use water spray to cool containers exposed to heat or fire to prevent pressure build up. Self-contained breathing apparatus should be used if product is involved in fire.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Closed containers may rupture due to pressure build up from extreme heat or fire.

FLAMMABILITY: Yes - Flammable aerosol under conditions of sparks, flame, or hot surfaces.

SENSITIVITY TO IMPACT: Aerosol cans are under pressure. Product will be expelled rapidly if container is punctured.

SENSITIVITY TO STATIC DISCHARGE: Primarily vapors

SECTION V - REACTIVITY DATA

STABILITY: Stable

CONDITIONS TO AVOID: Open flames, sparks, electrical arcs.

INCOMPATIBILITY (MATERIALS TO AVOID): Strong oxidizing agents.

HAZARDOUS DECOMPOSITION OR BY-PRODUCTS: Carbon Dioxide, Carbon Monoxide

HAZARDOUS POLYMERIZATION: Will not occur

SECTION VI - HEALTH HAZARD DATA

INHALATION: Respiratory tract irritant. May cause dizziness, light-headedness and / or headaches. Intentional misuse by deliberately concentrating and inhaling the contents may be harmful or fatal.

SKIN CONTACT: Prolonged or repeated contact may cause irritation and dermatitis.

EYE CONTACT: Painful with slight to moderate irritation.

INGESTION: May be harmful or fatal if swallowed.

EFFECTS OF CHRONIC OVEREXPOSURE: Reports have associated repeated and prolonged overexposure to solvents with permanent brain and nervous system damage. Repeated overexposure can also damage kidneys, lungs, liver, heart and blood.

CARCINOGENICITY: The ingredients are not listed as a human carcinogen by IARC, ACGIH, NTP, or OSHA.

TERATOGENICITY: Not established. **MUTAGENICITY:** Not established

MEDICAL CONDITION GENERALLY AGGRAVATED BY EXPOSURE: Not established.

EMERGENCY AND FIRST AID PROCEDURES: INHALATION - Remove from exposure, seek medical attention if signs/symptoms persist.
SKIN - Wash affected area with soap and water, remove contaminated clothing, seek medical attention if irritation persists.
EYES - Flush immediately with water for 15 minutes, seek medical attention if irritation persists.
INGESTION - DO not induce vomiting. Contact physician or poison control center immediately.

SECTION VII - PRECAUTIONS FOR SAFE HANDLING AND USE

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Remove all sources of ignition. Ventilate area. Prevent from entering a watercourse. Use an inert absorbent material and non-sparking type tools.

WASTE DISPOSAL METHOD: Dispose of in accordance with local, state and federal regulations. Do not incinerate closed containers.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: Do not store above 120° F. Do not store or use near heat, sparks or flame.

OTHER PRECAUTIONS: Do not smoke while using this product. Dust from sanding the dry paint films should be treated as a nuisance dust with a TLV of 15mg/cubic meter.

SECTION VIII - CONTROL MEASURES

RESPIRATORY PROTECTION: In areas with poor ventilation, use a NIOSH approved Organic Vapor Cartridge Respirator. For concentrations above the TLV (as defined in Section II), use a positive air supplied respirator.

VENTILATION: General ventilation to maintain exposure limits below TLV's as defined in Section II.

PROTECTIVE GLOVES: Chemical resistant gloves such as Neoprene or Nitrile rubber.

EYE PROTECTION: Safety glasses or goggles.

OTHER PROTECTIVE CLOTHING OR EQUIPMENT: None

WORK / HYGIENIC PRACTICES: Avoid prolonged or repeated contact. Do not breathe vapors. Wash contaminated clothing prior to reuse.

SECTION IX - DISCLAIMER

THE INFORMATION CONTAINED HEREIN IS BELIEVED TO BE ACCURATE BUT IS NOT WARRANTED TO BE SO. NOTHING CONTAINED HEREIN CONSTITUTES A SPECIFICATION NOR IS IT INTENDED TO WARRANT SUITABILITY FOR THE INTENDED USE.



660050-00 MOBILMET S 126
MATERIAL SAFETY DATA BULLETIN

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: MOBILMET S 126
SUPPLIER: EXXONMOBIL OIL CORPORATION
3225 GALLOWS RD.
FAIRFAX, VA 22037

24 - Hour Health and Safety Emergency (call collect): 609-737-4411

24 - Hour Transportation Emergency:
CHEMTREC: 800-424-9300 202-483-7616
LUBES AND FUELS: 281-834-3296

Product and Technical Information:

Lubricants and Specialties: 800-662-4525 800-443-9966
Fuels Products: 800-947-9147
MSDS Fax on Demand: 713-613-3661
MSDS Internet Website: <http://www.exxon.com>, <http://www.mobil.com>

2. COMPOSITION/INFORMATION ON INGREDIENTS

CHEMICAL NAMES AND SYNONYMS: SEVERE TREAT MIN. OILS & ADDITIVES

GLOBALLY REPORTABLE MSDS INGREDIENTS:

Substance Name	Approx. Wt%
CARBOXYLIC ACID ANHYDRIDE	5-15

See Section 8 for exposure limits (if applicable).

3. HAZARDS IDENTIFICATION

This product may be considered hazardous according to regulatory guidelines (See Section 15).

EMERGENCY OVERVIEW: Amber Liquid. DOT ERG No. : NA

POTENTIAL HEALTH EFFECTS: This product may be used in certain

applications where misting can occur. Excessive exposure to liquids and mists may cause skin and eye irritation. In addition, excessive exposure to mists may cause respiratory irritation and damage and aggravate pre-existing emphysema or asthma.

For further health effects/toxicological data, see Section 11.

4. FIRST AID MEASURES

EYE CONTACT: Flush thoroughly with water. If irritation occurs, call a physician.

SKIN CONTACT: Wash contact areas with soap and water. Remove and clean oil soaked clothing daily and wash affected area. (See Section 16 - Injection Injury)

INHALATION: If respiratory irritation, dizziness, nausea, or unconsciousness occurs due to excessive vapor or mist exposure, seek immediate medical assistance. If breathing has stopped, assist ventilation with a mechanical device or mouth-to-mouth resuscitation.

INGESTION: Not expected to be a problem. Seek medical attention if discomfort occurs. Do not induce vomiting.

NOTE TO PHYSICIANS: Pre-existing conditions which may be aggravated by exposure include emphysema and asthma.

5. FIRE-FIGHTING MEASURES

EXTINGUISHING MEDIA: Carbon dioxide, foam, dry chemical and water fog.

SPECIAL FIRE FIGHTING PROCEDURES: Water or foam may cause frothing. Use water to keep fire exposed containers cool. Water spray may be used to flush spills away from exposure. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply.

SPECIAL PROTECTIVE EQUIPMENT: For fires in enclosed areas, fire fighters must use self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS: None.

COMBUSTION PRODUCTS: Fumes, smoke, carbon monoxide, sulfur oxides, aldehydes and other decomposition products, in the case of incomplete combustion.

Flash Point C(F): 177(350) (ASTM D-92).

Flammable Limits (approx.% vol.in air) - LEL: NE, UEL: NE

NFPA HAZARD ID: Health: 0, Flammability: 1, Reactivity: 0

6. ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES: Report spills/releases as required to appropriate authorities. U.S. Coast Guard and EPA regulations require immediate reporting of spills/releases that could reach any waterway including intermittent dry creeks. Report spill/release to Coast Guard National Response Center toll free number (800)424-8802. In case of accident or road spill notify CHEMTREC (800) 424-9300.

PROCEDURES IF MATERIAL IS RELEASED OR SPILLED:

LAND SPILL: Shut off source taking normal safety precautions. Take

measures to minimize the effects on ground water. Recover by pumping or contain spilled liquid with sand or other suitable absorbent and remove mechanically into containers. If necessary, dispose of adsorbed residues as directed in Section 13.

WATER SPILL: This product emulsifies with water and is totally miscible. If spilled, shut off source and seek advice from a specialist. Notify relevant authorities.

ENVIRONMENTAL PRECAUTIONS: Prevent material from entering sewers, water sources or low lying areas; advise the relevant authorities if it has, or if it contaminates soil/vegetation.

PERSONAL PRECAUTIONS: See Section 8

7. HANDLING AND STORAGE

HANDLING: Avoid inhalation of vapors or mists. See Section 8 for additional personal protection advice when handling this product.

STORAGE: Keep containers closed when not in use. Do not store in open or unlabelled containers. Store away from strong oxidizing agents and combustible materials. Do not store near heat, sparks, flame or strong oxidants.

SPECIAL PRECAUTIONS: Prevent small spills and leakages to avoid slip hazard.

EMPTY CONTAINER WARNING: Empty containers retain residue (liquid and/or vapor) and can be dangerous. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION; THEY MAY EXPLODE AND CAUSE INJURY OR DEATH. Do not attempt to refill or clean container since residue is difficult to remove. Empty drums should be completely drained, properly bunged and promptly returned to a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

OCCUPATIONAL EXPOSURE LIMITS:

When mists/aerosols can occur, the following are recommended: 5 mg/m³ (as oil mist)- ACGIH Threshold Limit Value (TLV), 10 mg/m³ (as oil mist) - ACGIH Short Term Exposure Limit (STEL), 5 mg/m³ (as oil mist) - OSHA Permissible Exposure Limit (PEL)

VENTILATION: Use adequate ventilation, local exhaust, or enclosures to control below exposure limits.

RESPIRATORY PROTECTION: When ventilation is not adequate, wear approved respirator.

EYE PROTECTION: Chemical type goggles should be worn during misting operations. Normal industrial eye protection practices should be employed for other use conditions.

SKIN PROTECTION: Not normally required. When splashing or liquid contact can occur frequently, wear oil resistant gloves and/or other protective clothing. Good personal hygiene practices should always be followed.

9. PHYSICAL AND CHEMICAL PROPERTIES

Typical physical properties are given below. Consult Product Data Sheet for specific details.

APPEARANCE: Liquid
COLOR: Amber
ODOR: Sweet
ODOR THRESHOLD-ppm: NE
pH: NE
BOILING POINT C(F): > 100(212)
MELTING POINT C(F): NA
FLASH POINT C(F): 177(350) (ASTM D-92)
FLAMMABILITY (solids): NE
AUTO FLAMMABILITY C(F): NA
EXPLOSIVE PROPERTIES: NA
OXIDIZING PROPERTIES: NA
VAPOR PRESSURE-mmHg 20 C: NE
VAPOR DENSITY: > 2.0
EVAPORATION RATE: NE
RELATIVE DENSITY, 15/4 C: 0.893
SOLUBILITY IN WATER: Emulsifies
PARTITION COEFFICIENT: NE
VISCOSITY AT 40 C, cSt: > 20.0
VISCOSITY AT 100 C, cSt: NE
POUR POINT C(F): NE
FREEZING POINT C(F): NE
VOLATILE ORGANIC COMPOUND: NE
DMSO EXTRACT, IP-346 (WT.%): <3, for mineral oil only
NA=NOT APPLICABLE NE=NOT ESTABLISHED D=DECOMPOSES

FOR FURTHER TECHNICAL INFORMATION, CONTACT YOUR MARKETING REPRESENTATIVE

10. STABILITY AND REACTIVITY

STABILITY (THERMAL, LIGHT, ETC.): Stable.
CONDITIONS TO AVOID: Extreme heat and high energy sources of ignition.
Freezing temperatures.
INCOMPATIBILITY (MATERIALS TO AVOID): Strong oxidizers.
HAZARDOUS DECOMPOSITION PRODUCTS: Product does not decompose at
ambient temperatures.
HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL DATA

---ACUTE TOXICOLOGY---

ORAL TOXICITY (RATS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.
DERMAL TOXICITY (RABBITS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.
INHALATION TOXICITY (RATS): Practically non-toxic (LC50: greater than 5 mg/l). ---Based on testing of similar products and/or the

components.

EYE IRRITATION (RABBITS): Practically non-irritating. (Draize score: greater than 6 but 15 or less). ---Based on testing of similar products and/or the components.

SKIN IRRITATION (RABBITS): Practically non-irritating. (Primary Irritation Index: greater than 0.5 but less than 3). ---Based on testing of similar products and/or the components.

---CHRONIC TOXICOLOGY (SUMMARY)---

Repeated and/or prolonged exposure may cause irritation to the skin, eyes or respiratory tract. Overexposure to oil mist may result in oil droplet deposition and/or granuloma formation. The base oils in this product are severely solvent refined and/or severely hydrotreated. Chronic mouse skin painting studies of severely treated oils showed no evidence of carcinogenic effects.

---OTHER TOXICOLOGY DATA---

Small metal particles from machining may cause abrasion of the skin and may predispose to dermatitis.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL FATE AND EFFECTS:

ECOTOXICITY: Not established.

MOBILITY: Not established.

PERSISTENCE AND DEGRADABILITY: Not established.

BIOACCUMULATIVE POTENTIAL: Not established.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL: Product is suitable for burning in an enclosed, controlled burner for fuel value. Such burning may be limited pursuant to the Resource Conservation and Recovery Act. In addition, the product is suitable for processing by an approved recycling facility or can be disposed of at an appropriate government waste disposal facility. Use of these methods is subject to user compliance with applicable laws and regulations and consideration of product characteristics at time of disposal.

RCRA INFORMATION: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrosivity, or reactivity. The unused product is not formulated with substances covered by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

contact the supplier to confirm whether the ingredients in this product currently appear on a TSCA 4 or TSCA 12b list.
Code key:CARC=Carcinogen; SUS=Suspected Carcinogen; REPRO=Reproductive

16. OTHER INFORMATION

USE: WATER MISCIBLE CUTTING FLUID

NOTE: PRODUCTS OF EXXON MOBIL CORPORATION AND ITS AFFILIATED COMPANIES ARE NOT FORMULATED TO CONTAIN PCBS.

Health studies have shown that many hydrocarbons pose potential human health risks which may vary from person to person. Information provided on this MSDS reflects intended use. This product should not be used for other applications. In any case, the following advice should be considered:

INJECTION INJURY WARNING: If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

Precautionary Label Text:

CAUTION!

Excessive exposure to liquids and mists may cause skin and eye irritation. In addition, excessive exposure to mists may cause respiratory irritation and damage and aggravate pre-existing emphysema and asthma.

Keep container closed. Use with adequate ventilation.

FIRST AID: If inhaled and symptoms develop, remove to fresh air and get medical attention.

For industrial use only. Not intended or suitable for use in or around a household or dwelling.

Refer to product Material Safety Data Sheet for further safety and health information.

For Internal Use Only: MHC: 1* 1* 1* 1* 1*, MPPEC: A, TRN: 660050-00,
CMCS97: 971746, REQ: US - MARKETING, SAFE USE: L
EHS Approval Date: 17SEP2002

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Prepared by: ExxonMobil Oil Corporation
Environmental Health and Safety Department, Clinton, USA



CAMEO Chemicals



Chemical Datasheet

PETROLEUM LUBRICATING OIL

Chemical Identifiers

UN/NA Number	CAS Number	CHRIS Code	DOT Hazard Label
none	none	OLB	data unavailable

NFPA 704: data unavailable

General Description

Oily yellow-brown liquid. Less dense than water and insoluble in water. Hence floats on water. (USCG, 1999)

Hazards

Reactivity Alerts

none

Air & Water Reactions

Flammable. Insoluble in water.

Fire Hazard

No information available.

Health Hazard

INGESTION: minimal gastrointestinal tract irritation; increased frequency of bowel passage may occur.
ASPIRATION: pulmonary irritation is normally minimal but may become more severe several hours after exposure. (USCG, 1999)

Reactivity Profile

May be incompatible with strong oxidizing agents like nitric acid. Charring may occur followed by ignition of unreacted material and other nearby combustibles. In other settings, mostly unreactive. Not affected by aqueous solutions of acids, alkalis, most oxidizing agents, and most reducing agents. Burns exothermically when heated sufficiently or when ignited in the presence of air, oxygen or strong oxidizing agents.

Belongs to the Following Reactive Group(s)

- Hydrocarbons, Aliphatic Saturated

Response Recommendations

Firefighting

Fire Extinguishing Agents Not to Be Used: Water or foam may cause frothing.

Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide (USCG, 1999)

Non-Fire Response

No information available.

Protective Clothing

Protective gloves; goggles or face shield. (USCG, 1999)

First Aid

INGESTION: do NOT lavage or induce vomiting.

ASPIRATION: treatment probably not required; delayed development of pulmonary irritation can be detected by serial chest x-rays.

EYES: wash with copious quantity of water.

SKIN: wipe off and wash with soap and water. (USCG, 1999)

Physical Properties

Molecular Formula: data unavailable

Flash Point: 300.0 ° F (USCG, 1999)

Lower Explosive Limit: data unavailable

Upper Explosive Limit: data unavailable

Autoignition Temperature: data unavailable

Melting Point: data unavailable

Vapor Pressure: data unavailable

Vapor Density: data unavailable

Specific Gravity: 0.902 at 68.0 ° F (est.) (USCG, 1999)

Boiling Point: Very high (USCG, 1999)

Molecular Weight: data unavailable

Water Solubility: data unavailable

AEGL: data unavailable

ERPG: data unavailable

TEEL: data unavailable

IDLH: data unavailable

Regulatory Information

Regulatory Names: none

CAA RMP: Not a regulated chemical.

CERCLA: Not a regulated chemical.

EHS (EPCRA 302): Not a regulated chemical.

TRI (EPCRA 313): Not a regulated chemical.

RCRA Chemical Code: none

Alternate Chemical Names

- CRANKCASE OIL
- MOTOR OIL
- OILS, MISCELLANEOUS: LUBRICATING
- TRANSMISSION OIL



Printed in the U.S.A. SS94-63

MATERIAL SAFETY DATA SHEET

IDENTITY (As used on label and list): **MAG 1 SAE 10W 30 MOTOR OIL**
PRODUCT CODE: **MG03135G, MG0313PL, MG031330, MG031322, MG031355, M4136897, M4136890**

NFPA Hazard Identification 0 – Least 1 – Slight 2– Moderate 3 – High 4 - Extreme

Health: 0 Fire: 1 Reactivity: 0

Section I - General Information

Cascade Distributing, Inc.
2130 Superior Avenue
Cleveland, Ohio 44114

Information (402) 341-9397
Emergency (402) 677-1331 Chemtrec (800) 424-9300 Reviewed: 12/31/02

Section II - Composition/Information on Ingredients

COMPONENT NAME	%	CAS	OSHA PEL	ACGIH TLV
Lubricating Oil Base Stock	90-100	MIXTURE	5mg/m ³ *	5mg/m ³ *
Proprietary additives	1-10	MIXTURE	5mg/m ³ *	5mg/m ³ *

* Numbers are for oil mist

NON-HAZARDOUS INGREDIENTS

No IARC, NTP, OSHA and ACGIH listed carcinogens.

Section III - Hazards Identification

EYE CONTACT: Contact with eyes may cause eye irritation.

SKIN CONTACT: Prolonged or repeated contact may result in skin irritation or dermatitis.

INHALATION: Breathing oil mist in concentrations that exceed the TLV and PEL may result in respiratory discomfort and irritation.

INGESTION: Although this product has a low order of acute oral toxicity, aspiration of minute amounts into the lungs during ingestion or vomiting may cause mild to severe pulmonary injury and possibly death.

CARCINOGENICITY: This product has not been classified as a carcinogen or probable carcinogen by OSHA, NTP, or IARC.

SIGNS AND SYMPTOMS OF OVEREXPOSURE: May cause skin, eye, or respiratory irritation.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: None recognized

OTHER HEALTH INFORMATION: None

Section IV - First Aid Procedures

EYE CONTACT: If splashed into eyes, flush with water for 15 minutes or until irritation subsides. Get medical attention if irritation persists.

SKIN CONTACT: Remove contaminated clothing. Wash skin thoroughly with soap and water. Get medical attention if irritation persists.

INHALATION: If overcome by vapor from hot product, immediately remove victim to fresh air. If breathing has stopped, administer artificial respiration. Call for medical attention. If overexposed to oil mist, remove from further exposure.

INGESTION: DO NOT induce vomiting, call medical attention immediately.

Section V - Fire and Explosion Hazard Data

Flash Point (deg F): 420 Method Used: COC

Flammable or Explosive Limits (approximate % by volume in air) LEL: .9% UEL: 7%

EXTINGUISHING MEDIA: Use water spray, dry chemical, foam, or carbon dioxide. Use water to keep fireexposed containers cool. Water spray may be used to flush spills away from exposures.

SPECIAL FIRE FIGHTING PROCEDURES: Self-contained breathing apparatus may be required.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Water or foam may cause frothing.

Section VI - Accidental Release Measures

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Add sand, earth, or other suitable absorbent to spill area. Keep product out of sewers and waterways by damming or impounding.

Section VII - Handling and Storage

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Store in a cool, dry place with adequate ventilation. Do not expose to extreme temperatures or flames.

OTHER PRECAUTIONS: None

Section VIII - Exposure Controls/Personal Protection

RESPIRATORY PROTECTION: Use supplied-air respiratory protection in confined or enclosed space, if needed.

VENTILATION: Use local exhaust to capture vapor, mists or fumes, if necessary. Provide ventilation sufficient to prevent exceeding recommended exposure limit or buildup of explosive concentrations of vapor in air. Use explosion-proof equipment.

PROTECTIVE GLOVES: Use neoprene gloves, if needed, to avoid prolonged or repeated skin contact.

EYE PROTECTION: Wear goggles if there is likelihood of contact with eye(s).

OTHER PROTECTIVE EQUIPMENT: Use neoprene apron or other clothing, if needed, to avoid prolonged or repeated skin contact.

WORK PRACTICES/ENGINEERING CONTROLS: Keep containers closed when not in use.

PERSONAL HYGIENE: Wash skin thoroughly after contact, before breaks and meals, and at the end of the work period. Thoroughly clean contaminated clothing, including shoes, before re-use.

Section IX- Physical/Chemical Characteristics

Boiling Point (deg F): ND Specific Gravity (H₂O=1): .88 Vapor Pressure (mm Hg): <.01

Melting Point (deg F): -30 Vapor Density (Air=1): n/a Solubility in Water : Insoluble

Evaporation Rate (n-butyl Acetate=1): n/a

APPEARANCE AND ODOR: Amber to dark brown liquid, mild petroleum odor.

Section X - Reactivity Data

STABILITY: Stable

INCOMPATIBILITY (MATERIALS TO AVOID): Strong oxidants such as liquid chlorine, concentrated oxygen, sodium hypochlorite or calcium hypochlorite

HAZARDOUS DECOMPOSITION OR BYPRODUCTS: Carbon monoxide, sulfur oxides, aldehydes, and other petroleum decomposition products in the case of incomplete combustion. Oxides of nitrogen, phosphorus, sulfur, calcium, copper, magnesium, sodium and hydrogen sulfide may also be present.

HAZARDOUS POLYMERIZATION: Will not occur

CONDITIONS TO AVOID: None

Section XI - Toxicological Information

See Section IV

Section XII - Ecological Information

Section XIII - Disposal Considerations

WASTE DISPOSAL METHOD: Place in an appropriate disposal facility in compliance with local regulations.

Section XIV - Transport Information

NOT A REGULATED ITEM ACCORDING TO DOT.

Section XV-Regulatory Information

SARA SECTION 313: This product contains from 0.5 to 1.4 % zinc compounds

WHMIS classification for product: This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

This material safety data sheet and the information it contains is offered to you in good faith as accurate. We have reviewed any information contained in the data sheet which we received from sources outside our company and we believe that information to be correct, but cannot guarantee its accuracy or completeness. Health and safety precautions in this data sheet may not be adequate for all individuals and/or situations. It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. No statement made in this data sheet shall be construed as permission or recommendation for the use of any product in a manner that might infringe existing patents. No warranty is made, either expressed or implied.



Material Safety Data Sheet

MSDS ID NO.: 0178MAR019
Revision date: 06/02/2006

1. CHEMICAL PRODUCT AND COMPANY INFORMATION

Product code: MR0295

Product name: Marathon Marine-Terrain 2-Cycle Engine Oil
Synonym: Marine-Terrain 2-Cycle Engine Oil; Marine Terrain TC-W3; Marathon 2 Cycle Oil
Chemical Family: Motor/Lube Oil
Formula: Mixture

Manufacturer:
Marathon Petroleum Company LLC
539 South Main Street
Findlay OH 45840

Other information: 419-421-3070
Emergency telephone number: 877-627-5463

2. COMPOSITION/INFORMATION ON INGREDIENTS

2-Cycle Oil is a complex mixture of highly refined lubricating oil base stocks, 170 Solvent (Stoddard Solvent) and additives.

Product information:

Name	CAS Number	Weight %	ACGIH Exposure Limits:	OSHA - Vacated PELs - Time Weighted Ave	Other:
Marathon Marine-Terrain 2-Cycle Engine Oil	Mixture	100			

Component Information:

Name	CAS Number	Weight %	ACGIH Exposure Limits:	OSHA - Vacated PELs - Time Weighted Ave	Other:
Petroleum Distillates, Hydrotreated Heavy Paraffinic	64742-54-7	52-55			Mineral Oil Mist (MOM) =5 mg/m ³ TWA = 10 mg/m ³ STEL
Distillates Petroleum, Hydrotreated Light	64742-47-8	25-30	= 200 mg/m ³ TWA application restricted to conditions in which there are negligible aerosol exposures skin - potential for cutaneous absorption (as total hydrocarbon vapor)		
Additives	Not specified	16-19			

Notes:

The manufacturer has voluntarily elected to reflect exposure limits contained in OSHA's 1989 air contaminants standard in its MSDS's, even though certain of those exposure limits were vacated in 1992.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

2-CYCLE OIL IS CONSIDERED TO BE A COMBUSTIBLE LIQUID PER THE OSHA HAZARD COMMUNICATION STANDARD AND SHOULD BE KEPT AWAY FROM HEAT, FLAME AND OTHER SOURCES OF IGNITION. IF SWALLOWED, THE VOLATILE COMPONENTS OF THIS PRODUCT MAY GET SUCKED INTO THE LUNGS (ASPIRATED) AND CAUSE LUNG DAMAGE OR EVEN DEATH.

OSHA WARNING LABEL:

**WARNING.
COMBUSTIBLE LIQUID.
ASPIRATION (INADVERTENT SUCTION) OF LIQUID INTO THE LUNGS CAN PRODUCE CHEMICAL PNEUMONIA
OR EVEN DEATH.**

CONSUMER WARNING LABEL:

A CONSUMER WARNING LABEL IS NOT APPLICABLE FOR THIS PRODUCT.

Inhalation: Exposure to high vapor concentrations may produce headache, giddiness, vertigo, and anesthetic stupor.

Ingestion: Ingestion may result in nausea, vomiting, diarrhea and central nervous system depression. Aspiration (inadvertent suction) of liquid into the lungs must be avoided as even small quantities in the lungs can produce chemical pneumonitis, pulmonary edema/hemorrhage and even death.

Skin contact: May cause mild skin irritation. Prolonged or repeated liquid contact can cause dermatitis, folliculitis or oil acne.

Eye contact: Eye irritation may result from contact with the liquid or exposure to the vapor at concentrations above the TLV.

Carcinogenic Evaluation:

Product information:

Name	IARC Carcinogens:	NTP Carcinogens:	ACGIH - Carcinogens:	OSHA - Select Carcinogens:
Marathon Marine-Terrain 2-Cycle Engine Oil Mixture	NE			

Notes: The International Agency for Research on Cancer (IARC) has determined that there is no evidence that severely solvent-refined oils are carcinogenic to experimental animals.

Component Information:

Name	IARC Carcinogens:	NTP Carcinogens:	ACGIH - Carcinogens:	OSHA - Select Carcinogens:
Distillates Petroleum, Hydrotreated Light 64742-47-8			A3 - Animal Carcinogen (as total hydrocarbon vapor)	

Notes: The International Agency for Research on Cancer (IARC) has determined that there is inadequate evidence for the carcinogenicity of aliphatic hydrocarbon solvents in humans. Therefore, aliphatic hydrocarbon solvents are not classifiable as to their carcinogenicity to humans (Group 3)

4. FIRST AID MEASURES

Inhalation:	If affected, move person to fresh air. If breathing is difficult, administer oxygen. If not breathing or if no heartbeat, give artificial respiration or cardiopulmonary resuscitation (CPR). Immediately call a physician. If symptoms or irritation occur with any exposure, call a physician.
Skin contact:	Wash with soap and large amounts of water. Remove contaminated clothing. If symptoms or irritation occur, call a physician.
Ingestion:	If swallowed, do not induce vomiting and do not give liquids. Immediately call a physician.
Eye contact:	Flush eyes with large amounts of tepid water for at least 15 minutes. If symptoms or irritation occur, call a physician.
Notes to physician:	High velocity injection under the skin may result in serious injury. If left untreated the affected area is subject to infection, disfigurement, lack of blood circulation and may require amputation. When dispensed by high pressure equipment this material can easily penetrate the skin and leave a bloodless puncture wound. Material injected into a finger can be deposited into the palm of the hand. Within 24-48 hours the patient may experience swelling, discoloration, and throbbing pain in the affected area. Immediate treatment by a surgical specialist is recommended.
Medical conditions aggravated by exposure:	Skin contact could aggravate an existing skin disorder or dermatitis condition.

5. FIRE FIGHTING MEASURES

Suitable extinguishing media:	For small fires, Class B fire extinguishing media such as CO ₂ , dry chemical, foam (AFFF/ATC) or water spray can be used. For large fires, water spray, fog or foam (AFFT/ATC) can be used. Fire fighting should be attempted only by those who are adequately trained and equipped with proper protective equipment.
Specific hazards:	This product has been determined to be a combustible liquid per the OSHA Hazard Communication Standard and should be handled accordingly. For additional fire related information, see NFPA 30 or the North American Emergency Response Guide 128.
Special protective equipment for firefighters:	Avoid using straight water streams. Water spray and foam (AFFF/ATC) must be applied carefully to avoid frothing and from as far a distance as possible. Avoid excessive water spray application. Use water spray to cool exposed surfaces from as far a distance as possible. Keep run-off water out of sewers and water sources.
Flash point:	149 F, 65 C (PMCC)
Autoignition temperature:	No data available.
Flammable limits in air - lower (%):	1
Flammable limits in air - upper (%):	6
<u>NFPA rating:</u>	<u>HMIS classification:</u>
Health: 2	Health: 2
Flammability: 2	Flammability: 2
Reactivity: 0	Reactivity: 0
Other: -	Special: *See Section 8 for guidance in selection of personal protective equipment.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions: Keep public away. Isolate and evacuate area. Shut off source if safe to do so. Advise authorities and National Response Center (800-424-8802) if substance has entered a watercourse or sewer. Advise local and state emergency services agencies, if appropriate. Contain liquid with sand or soil. Recover and return free product to proper containers. Use suitable absorbent materials such as vermiculite, sand, or clay to clean up residual liquids.

7. HANDLING AND STORAGE

Handling:

Comply with all applicable EPA, OSHA, NFPA and consistent state and local requirements. Use appropriate grounding and bonding practices. Store in properly closed containers that are appropriately labeled and in a cool well-ventilated area. Do not cut, drill, grind or weld on empty containers since they may contain explosive residues. Do not pressurize or expose to heat, open flames, strong oxidizers or other sources of ignition.

Hydrocarbons are basically non-conductors of electricity and can become electrostatically charged during mixing, filtering, pumping at high flow rates or loading and transfer operations. If this charge reaches a sufficiently high level, sparks can form that may ignite the vapors of flammable liquids. Sudden release of hot organic chemical vapors or mists from process equipment operating under elevated temperature and pressure, or sudden ingress of air into vacuum equipment may result in ignitions without the presence of obvious ignition sources. Nozzle spouts must be kept in contact with the containers or tank during the entire filling operation.

Never siphon this product by mouth. Avoid repeated and prolonged skin contact. Exercise good personal hygiene including removal of soiled clothing and prompt washing with soap and water.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

PERSONAL PROTECTIVE EQUIPMENT

Engineering measures: Local or general exhaust required when using at elevated temperatures that generate vapors or mists.

Respiratory protection: Not required under normal conditions and adequate ventilation. Approved organic vapor chemical cartridge or supplied air respirators should be worn when significant vapors are generated. Observe respirator protection factor criteria cited in ANSI Z88.2. Self-contained breathing apparatus should be used for fire fighting.

Skin and body protection: Use chemical resistant gloves such as neoprene, nitrile, or PVA to prevent prolonged or repeated skin contact.

Eye protection: No special eye protection is normally required.

Hygiene measures: No data available.

9. PHYSICAL AND CHEMICAL PROPERTIES:

Appearance:	Blue-green Liquid
Physical state (Solid/Liquid/Gas):	Liquid
Substance type (Pure/Mixture):	Mixture
Color:	Blue-Green
Odor:	Hydrocarbon
Molecular weight:	Not determined.
pH:	Neutral
Boiling point/range (5-95%):	315-398 F, 157.2-203.3 C
Melting point/range:	Not determined.

Decomposition temperature:	Not applicable.
Specific gravity:	Not determined
Density:	7.27 lbs/gal @ 60 F
Bulk density:	No data available.
Vapor density:	No data available.
Vapor pressure:	<2 mm Hg @ 68 F
Evaporation rate:	No data available.
Solubility:	<1%
Solubility in other solvents:	No data available.
Partition coefficient (n-octanol/water):	No data available.
VOC content(%):	10-25
Viscosity:	7.6 cSt @ 100 C 5,450 cP @ -25 C

10. STABILITY AND REACTIVITY

Stability:	The material is stable at 70 F, 760 mm pressure.
Polymerization:	Will not occur.
Hazardous decomposition products:	Carbon monoxide, carbon dioxide, aldehydes and hydrocarbons.
Materials to avoid:	Strong oxidizers such as nitrates, chlorates, peroxides.
Conditions to avoid:	Heat and open flames.

11. TOXICOLOGICAL INFORMATION

Acute toxicity:

Product information:

Name	CAS Number	Inhalation:	Dermal:	Oral:
Marathon Marine-Terrain 2-Cycle Engine Oil	Mixture	LD50 = 2.18 to > 4 mg/l [Rat]	LD50 > 2 gm/kg [Rabbit]	LD50 > 2 gm/kg [Rat]

Chronic skin painting studies with severely solvent refined neutral oils did not produce evidence of skin cancer in mice.

This product contains 10-20% Stoddard Solvent. Ninety day and two year inhalation studies of mineral spirits (stoddard solvent) were conducted in mice and rats at concentrations of 138, 275, 550, 1,100 and 2,200 mg/m³. In the 90 day studies, no significant toxicity was observed in rats except for nasal irritation at the highest dose and the previously noted effects in the male rat kidney. No significant toxicity was observed in mice except for slight effects in the spleen of female mice. No evidence of carcinogenic activity was observed in male mice or female rats chronically exposed to stoddard solvent. There was equivocal evidence that stoddard solvent produced benign liver tumors in female mice (an effect associated with increased body weight) and some evidence that stoddard solvent produced adrenal tumors in male rats. This latter effect is believed to be a secondary response to the kidney disease mediated by alpha-2μ-microglobulin. Some components of this product, have been shown to produce a species specific, sex hormonal dependent kidney lesion in male rats from repeated oral or inhalation exposure. Subsequent research has shown that the kidney damage develops via the formation of a alpha-2μ-globulin, a mechanism unique to the male rat. Humans do not form alpha-2μ-globulin, therefore, the kidney effects resulting from this mechanism are not relevant in humans.

Used motor oil applied to the skin of rabbits at doses of 8 ml/kg/day, 5 days/wk, for two weeks, produced significant weight loss and skin irritation but no mortality. Used motor oil was found to produce skin tumors in mice in lifetime skin painting studies. Solvent extracts of used motor oils were found to be positive in the Ames mutagenicity test.

12. ECOLOGICAL INFORMATION

Ecotoxicity effects:

Water accomated fractions (WAF) of highly refined base oils did not produce acute toxicity in fish (100-1000 mg/l), fresh water algae (500 mg/l) or daphnia (10,000 mg/l) in 48-96 hour LC50 studies. The 96 hour LC50 of a water accomadated fraction (WAF) of mineral spirits is >1,000 mg/l in rainbow trout.

Used motor and/or lube oils can be toxic to birds and fish.

13. DISPOSAL CONSIDERATIONS

Cleanup Considerations:

This material as supplied and by itself, when discarded or disposed of, is not an EPA RCRA hazardous waste according to federal regulations. This material could become a hazardous waste if mixed or contaminated with a hazardous waste or other substance(s). It is the responsibility of the user to determine if disposal material is hazardous according to federal, state and local regulations.

Don't pollute. Conserve resources. Send used product to recycling center. Dispose of cleanup materials in accordance with applicable local, state and federal regulations.

14. TRANSPORT INFORMATION

49 CFR 172.101:**DOT:**

Transport Information: This material when transported via US commerce would be regulated by DOT Regulations.

Proper shipping name:	Petroleum Products, N.O.S.
UN/Identification No:	UN 1268
Hazard Class:	3
Packing group:	III
DOT reportable quantity (lbs):	Not applicable.

TDG (Canada):

Proper shipping name:	Petroleum Products, N.O.S.
UN/Identification No:	UN 1268
Hazard Class:	3
Packing group:	III
Regulated substances:	Not applicable.

15. REGULATORY INFORMATION

Federal Regulatory Information:

US TSCA Chemical Inventory Section 8(b): This product and/or its components are listed on the TSCA Chemical Inventory.

OSHA Hazard Communication Standard: This product has been evaluated and determined to be hazardous as defined in OSHA's Hazard Communication Standard.

EPA Superfund Amendment & Reauthorization Act (SARA):

SARA Section 302: This product contains the following component(s) that have been listed on EPA's Extremely Hazardous Substance (EHS) List:

Name	CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs
Petroleum Distillates, Hydrotreated Heavy Paraffinic	NA
Distillates Petroleum, Hydrotreated Light	NA
Additives	NA

SARA Section 304:

This product contains the following component(s) identified either as an EHS or a CERCLA Hazardous substance which in case of a spill or release may be subject to SARA reporting requirements:

Name	CERCLA/SARA - Hazardous Substances and their Reportable Quantities
Petroleum Distillates, Hydrotreated Heavy Paraffinic	NA
Distillates Petroleum, Hydrotreated Light	NA
Additives	NA

SARA Section 311/312:

The following EPA hazard categories apply to this product:

Acute Health Hazard
Fire Hazard

SARA Section 313:

This product contains the following component(s) that may be subject to reporting on the Toxic Release Inventory (TRI) From R:

Name	CERCLA/SARA 313 Emission reporting:
Petroleum Distillates, Hydrotreated Heavy Paraffinic	None
Distillates Petroleum, Hydrotreated Light	None
Additives	None

State and Community Right-To-Know Regulations:

The following component(s) of this material are identified on the regulatory lists below:

Petroleum Distillates, Hydrotreated Heavy Paraffinic

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	Not Listed.
Pennsylvania Right-To-Know:	Not Listed.
Massachusetts Right-To Know:	Not Listed.
Florida substance List:	Not Listed.
Rhode Island Right-To-Know:	Not Listed
Michigan critical materials register list:	Not Listed.
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Not Listed
New Jersey - Environmental Hazardous Substances List:	Not Listed
Illinois - Toxic Air Contaminants	Not Listed
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed

Distillates Petroleum, Hydrotreated Light

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	Not Listed.

Pennsylvania Right-To-Know:	Not Listed.
Massachusetts Right-To Know:	Not Listed.
Florida substance List:	Not Listed.
Rhode Island Right-To-Know:	Not Listed
Michigan critical materials register list:	Not Listed.
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Not Listed
New Jersey - Environmental Hazardous Substances List:	Not Listed
Illinois - Toxic Air Contaminants	Not Listed
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed

Additives

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	Not Listed.
Pennsylvania Right-To-Know:	Not Listed.
Massachusetts Right-To Know:	Not Listed.
Florida substance List:	Not Listed.
Rhode Island Right-To-Know:	Not Listed
Michigan critical materials register list:	Not Listed.
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Not Listed
New Jersey - Environmental Hazardous Substances List:	Not Listed
Illinois - Toxic Air Contaminants	Not Listed
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed

Canadian Regulatory Information:

Canada DSL/NDSL Inventory: This product and/or its components are listed either on the Domestic Substances List (DSL) or are exempt.

16. OTHER INFORMATION

Additional Information: No data available.

Prepared by: Craig M. Parker Manager, Toxicology and Product Safety

The information and recommendations contained herein are based upon tests believed to be reliable. However, Marathon Petroleum Company LLC (MPC) does not guarantee their accuracy or completeness nor shall any of this information constitute a warranty, whether expressed or implied, as to the safety of the goods, the merchantability of the goods, or the fitness of the goods for a particular purpose. Adjustment to conform to actual conditions of usage maybe required. MPC assumes no responsibility for results obtained or for incidental or consequential damages, including lost profits arising from the use of these data. No warranty against infringement of any patent, copyright or trademark is made or implied.

End of Safety Data Sheet



CAMEO Chemicals



Chemical Datasheet

PETROLEUM LUBRICATING OIL

Chemical Identifiers

UN/NA Number	CAS Number	CHRIS Code	DOT Hazard Label
none	none	OLB	data unavailable

NFPA 704: data unavailable

General Description

Oily yellow-brown liquid. Less dense than water and insoluble in water. Hence floats on water. (USCG, 1999)

Hazards

Reactivity Alerts

none

Air & Water Reactions

Flammable. Insoluble in water.

Fire Hazard

No information available.

Health Hazard

INGESTION: minimal gastrointestinal tract irritation; increased frequency of bowel passage may occur.
ASPIRATION: pulmonary irritation is normally minimal but may become more severe several hours after exposure. (USCG, 1999)

Reactivity Profile

May be incompatible with strong oxidizing agents like nitric acid. Charring may occur followed by ignition of unreacted material and other nearby combustibles. In other settings, mostly unreactive. Not affected by aqueous solutions of acids, alkalis, most oxidizing agents, and most reducing agents. Burns exothermically when heated sufficiently or when ignited in the presence of air, oxygen or strong oxidizing agents.

Belongs to the Following Reactive Group(s)

- Hydrocarbons, Aliphatic Saturated

Response Recommendations

Firefighting

Fire Extinguishing Agents Not to Be Used: Water or foam may cause frothing.

Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide (USCG, 1999)

Non-Fire Response

No information available.

Protective Clothing

Protective gloves; goggles or face shield. (USCG, 1999)

First Aid

INGESTION: do NOT lavage or induce vomiting.

ASPIRATION: treatment probably not required; delayed development of pulmonary irritation can be detected by serial chest x-rays.

EYES: wash with copious quantity of water.

SKIN: wipe off and wash with soap and water. (USCG, 1999)

Physical Properties

Molecular Formula: data unavailable

Flash Point: 300.0 ° F (USCG, 1999)

Lower Explosive Limit: data unavailable

Upper Explosive Limit: data unavailable

Autoignition Temperature: data unavailable

Melting Point: data unavailable

Vapor Pressure: data unavailable

Vapor Density: data unavailable

Specific Gravity: 0.902 at 68.0 ° F (est.) (USCG, 1999)

Boiling Point: Very high (USCG, 1999)

Molecular Weight: data unavailable

Water Solubility: data unavailable

AEGL: data unavailable

ERPG: data unavailable

TEEL: data unavailable

IDLH: data unavailable

Regulatory Information

Regulatory Names: none

CAA RMP: Not a regulated chemical.

CERCLA: Not a regulated chemical.

EHS (EPCRA 302): Not a regulated chemical.

TRI (EPCRA 313): Not a regulated chemical.

RCRA Chemical Code: none

Alternate Chemical Names

- CRANKCASE OIL
- MOTOR OIL
- OILS, MISCELLANEOUS: LUBRICATING
- TRANSMISSION OIL

ITEM: 4VE27 - Pressure Gauge 2 1/2 In 0 to 300 P

MSDS: A9303

ORDER: 0059516566

LP NUMBER: U255360642-A

MATERIAL SAFETY DATA SHEET (MSDS)

This MSDS should be attached or kept with the respective product with which it is associated.

MATERIAL SAFETY DATA SHEET - A9303

Associated Grainger Items
4VB76, 4VB77, 4VB78, 4VE79, 4VB80, 4VB81, 4VB82, 4VB83, 4VB84, 4VB85, 4VB86
4VE95, 4VB96, 4VB97, 4VB98, 4VB99, 4VE10, 4VE11, 4VE12, 4VE13, 4VE14, 4VE15
4VE16, 4VE17, 4VE18, 4VE19, 4VE20, 4VE21, 4VE22, 4VE23, 4VE24, 4VE25, 4VE26
4VE27, 4VE28, 4VE29, 4VE30, 4VE31, 4VE32, 4VE33, 4VE34, 4VE35, 4VE36, 4VE37
4VE38, 4VE39, 4VE40, 4VE41, 4VE42, 4VE43, 4VE44

PROCTER & GAMBLE CHEMICALS

MATERIAL SAFETY DATA SHEET

MSDS NUMBER: GLYC304-2

SUPERSEDES: GLYC304-1

REVISION DATE: APRIL 26, 2004

ISSUE DATE: JULY 20, 2002

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

PRODUCT IDENTIFICATION:

SYNONYMS: GLYCEROL

TRADE NAMES:
MOON GLYCERINE USP, FCC
MOON KOSHER GLYCERINE USP, FCC

PRODUCT USES:
MULTIPLE USES INCLUDING AS EMULSIFIER, EMOLLIENT, PLASTICIZER, HUMECTANT,
SWEETENER, ANTI-FREEZE, IN SURFACE COATINGS AND PAINTS, COSMETICS, DRUG AND
FOOD PRODUCTS. INTERMEDIATE FOR MAKING GLYCEROL DERIVATIVES.

COMPANY/UNDERTAKING IDENTIFICATION:

NORTH AMERICA:
THE PROCTER & GAMBLE COMPANY
PROCTER & GAMBLE CHEMICALS
SHARON WOODS TECHNICAL CENTER
11530 REED HARTMAN HIGHWAY
CINCINNATI, OHIO 45241

DEPARTMENT ISSUING MSDS:
PRODUCT SAFETY AND REGULATORY AFFAIRS 1-800-477-8899

EUROPE:
PROCTER & GAMBLE EUROPEAN SUPPLY COMPANY N.V.
P&G CHEMICALS - EUROPE
THE HEIGHTS BROOKLANDS
WEYBRIDGE SURRY
ENGLAND KT13 0XP
TELEPHONE NUMBER: 01932-896000

EMERGENCY TELEPHONE:
P&G LTD. - BROOKLANDS, ENGLAND:
TEL: 01932-896000 (DAY PHONE)
EMERGENCY: 0191-279-2000 (DAY PHONE)

CHEMTREC:
1-800-424-9300 U.S. AND CANADA
1-703-527-3887 FOR CALLS ORIGINATING ELSEWHERE

U.S. EMERGENCY, QUALITY OR SERVICE ISSUES:
CALL CUSTOMER SERVICE: 1-800-477-8899 OR 513-626-6882

2. COMPOSITION/INFORMATION ON INGREDIENTS

SUBSTANCE/PREPARATION (MIXTURE): SUBSTANCE

Table with 5 columns: CAS NO., WT/WT %, EC-NO., EC SYMBOLS, EC R-PHASES. Row 1: 1,2,3-PROPANETRIOL, 56-81-5, 99-100, 2002895, NOT APPLICABLE NOT APPLICABLE

OCCUPATIONAL EXPOSURE LIMITS, IF APPLICABLE, ARE LISTED IN SECTION 8
LC/LD50 INFORMATION IS LISTED IN SECTION 11.
FULL TEXT OF R PHRASE(S) ARE LISTED IN SECTION 16.

3. HAZARDS IDENTIFICATION

EUROPEAN HAZARD CLASSIFICATION:
THIS PRODUCT IS NOT CLASSIFIED AS DANGEROUS ACCORDING TO DIRECTIVE
67/548/EEC.

POTENTIAL HEALTH EFFECTS:

EYE - CONCENTRATED SOLUTIONS MAY CAUSE MILD TRANSIENT IRRITATION.

SKIN - UNLIKELY TO BE IRRITANT. HEATED PRODUCT MAY CAUSE THERMAL BURNS IF CONTACTED.

INHALATION - NOT APPLICABLE AT AMBIENT TEMPERATURE. GLYCERINE MIST MAY BE IRRITATIVE TO RESPIRATORY TRACT.

INGESTION - UNLIKELY TO BE HARMFUL UNLESS EXCESSIVE AMOUNT.

PHYSICAL/CHEMICAL HAZARDS:
CONTACT OF GLYCERINE WITH STRONG OXIDIZING AGENTS SUCH AS NITRIC ACID OR
OTHER STRONG ACIDS, CHROMIUM TRIOXIDE, POTASSIUM CHLORATE, OR POTASSIUM
PERMANGANATE MAY CAUSE AN EXPLOSION.

ENVIRONMENTAL HAZARDS: PRODUCT IS BIODEGRADABLE

4. FIRST AID MEASURES

EYE - IMMEDIATELY FLUSH WITH COPIOUS AMOUNTS OF WATER. GET MEDICAL ATTENTION IF IRRITATION PERSISTS.

SKIN - WASH THOROUGHLY WITH PLENTY OF WATER AND SOAP.

INHALATION - REMOVE TO FRESH AIR.

INGESTION - REMOVE MATERIAL FROM MOUTH. DRINK PLENTY OF WATER. IF LARGE AMOUNT SWALLOWED OR SYMPTOMS DEVELOP GET MEDICAL ATTENTION.

5. FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA:
USE WATER, ALCOHOL RESISTANT FOAM, CO2 OR DRY CHEMICAL.

UNSUITABLE EXTINGUISHING MEDIA: NOT APPLICABLE

FLASH POINT AND METHOD: >390 DEG. F (198.9 DEG. C) PMCC

EXPLOSIVE LIMITS IN AIR: NOT APPLICABLE

AUTO-IGNITION TEMPERATURE: APPROX. 752 DEG. F (APPROX. 400 DEG. C)

SENSITIVITY TO MECHANICAL IMPACT/STATIC DISCHARGE: NOT AVAILABLE

SPECIAL PROTECTIVE EQUIPMENT:
WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING.

OTHER FIRE FIGHTING CONSIDERATIONS:
CONTACT OF GLYCERINE WITH STRONG OXIDIZING AGENTS SUCH AS NITRIC ACID OR
OTHER STRONG ACIDS, CHROMIUM TRIOXIDE, POTASSIUM CHLORATE, OR POTASSIUM
PERMANGANATE MAY CAUSE AN EXPLOSION.

EXPOSURE HAZARDS: DURING BURNING POISONOUS ACROLEIN MAY BE FORMED.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS:
WEAR RESPIRATOR, SUITABLE GLOVES AND EYE/FACE PROTECTION.

ENVIRONMENTAL PRECAUTIONS:
MINIMIZE CONTAMINATION OF DRAINS, SURFACE AND GROUND WATERS.

PROCEDURES FOR SPILL/LEAK CLEAN-UP:
TRANSFER PRODUCT TO SUITABLY LABELED CONTAINERS FOR DISPOSAL AT AN APPROVED
SITE. ABSORB LIQUID SPILLAGE ONTO INERT MATERIAL (E.G. SAND).
RESIDUES AND SMALL SPILLAGES MAY BE WASHED AWAY WITH WATER AND DETERGENT.

REFER TO SECTION 8 FOR ADDITIONAL PERSONAL PROTECTION INFORMATION.
REFER TO SECTION 13 FOR DISPOSAL CONSIDERATIONS.

7. HANDLING AND STORAGE

HANDLING:
NO SPECIAL PRECAUTIONS REQUIRED, BUT AVOID EYE AND SKIN CONTACT AS PART OF
NORMAL INDUSTRIAL HYGIENE.
PREVENT FORMATION OF MIST. EYE AND SKIN CONTACT SHOULD BE AVOIDED IF
HANDLING AT ELEVATED TEMPERATURES.

STORAGE:
STORE IN CLEAN TIGHT CONTAINERS TO PREVENT MOISTURE PICKUP FROM AIR. CAN BE
STORED IN ALUMINUM, STAINLESS STEEL, FIBERGLASS OR RESIN LINED STEEL
VESSELS.

OTHER RECOMMENDATIONS:
AVOID CONTACT WITH STRONG OXIDIZING AGENTS SUCH AS NITRIC ACID OR OTHER
STRONG ACIDS, CHROMIUM TRIOXIDE, POTASSIUM CHLORATE, OR POTASSIUM
PERMANGANATE.

SPECIFIC USE(S):
FOLLOW BULK HANDLING AND STORAGE PROCEDURES AS NOTED ABOVE.

REFER TO SECTION 6 FOR CLEAN-UP OF SPILLAGES.
REFER TO SECTION 13 FOR DISPOSAL CONSIDERATIONS.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

GENERAL PRECAUTIONS:
GOOD INDUSTRIAL HYGIENE SHOULD BE FOLLOWED. AVOID BREATHING MIST.

EXPOSURE LIMIT VALUES - GLYCERINE:
AUSTRALIA - TWA 10 MG/M3
BELGIUM - TWA 10 MG/M3

CANADA:
ALBERTA - TWA 10 MG/M3
BRITISH COLUMBIA - TWA 10 MG/M3
ONTARIO - TWA 10 MG/M3
QUEBEC - TWA 10 MG/M3

FRANCE - TWA (VMB) 10 MG/M3
FINLAND - 8 HOUR LIMIT 20 MG/M3
IRELAND - 8 HOUR OEL (TWA) 10 MG/M3
ITALY - 8 HOUR TWA 10 MG/M3
KOREA - TWA 10 MG/M3
MALAYSIA - TWA 10 MG/M3
MEXICO - TWA 10 MG/M3
NEW ZEALAND - TWA 10 MG/M3
SINGAPORE - 8-HOUR PEL (TWA) 10 MG/M3
SPAIN - 8 HOUR DAILY EXPOSURE LIMIT (VLA-ED) 10 MG/M3
THE NETHERLANDS - MAC TWA (TGG) 10 MG/M3
UNITED KINGDOM - TWA 10 MG/M3

UNITED STATES - ACGIH - GLYCERINE MIST - TLV-TWA 10 MG/M3
OSHA 2-1 PEL GLYCERINE MIST, RESPIRABLE FRACTION - 5 MG/M3
OSHA 2-1 PEL GLYCERINE MIST, TOTAL DUST - 15 MG/M3

EXPOSURE CONTROLS:

ENGINEERING CONTROLS:

VENTILATION: LOCAL EXHAUST - PREFERRED MECHANICAL (GENERAL) ACCEPTABLE PROVIDE VENTILATION TO MEET EXPOSURE LIMITS.

PERSONAL PROTECTIVE EQUIPMENT:

EYE - NONE REQUIRED, ALTHOUGH EYE PROTECTION IS RECOMMENDED AS PART OF GOOD INDUSTRIAL HYGIENE.

SKIN - PROTECTIVE GLOVES: NONE REQUIRED WITH NORMAL USE.

INHALATION - AN APPROPRIATE NIOSH/MSHA APPROVED RESPIRATOR SHOULD BE USED IF A MIST OR VAPOR IS GENERATED. A NIOSH/MSHA APPROVED SELF-CONTAINED BREATHING APPARATUS OR AIR-SUPPLIED RESPIRATOR IS RECOMMENDED IF THE CONCENTRATION EXCEEDS THE CAPACITY OF CARTRIDGE RESPIRATOR.

WARNING: AIR PURIFYING RESPIRATORS DO NOT PROTECT WORKERS IN OXYGEN-DEFICIENT ATMOSPHERES.

OTHER CONTROLS: NONE REQUIRED.

ENVIRONMENTAL EXPOSURE CONTROLS: CONTACT PROCTER AND GAMBLE FOR SPECIFIC COMMUNITY INFORMATION.

9. PHYSICAL AND CHEMICAL PROPERTIES

GENERAL INFORMATION: PHYSICAL STATE: LIQUID APPEARANCE: WATER WHITE, CLEAR ODOR: BLAND ODOR; SWEET TASTE ODOR THRESHOLD: NOT AVAILABLE

IMPORTANT HEALTH, SAFETY AND ENVIRONMENTAL INFORMATION:

pH: NEUTRAL

BOILING POINT/BOILING RANGE: > 550 DEG. F (288 DEG. C) @ 760 MM HG (101.3KPA)

FLASH POINT & METHOD: >390 DEG. F (198.9 DEG. C) FMCC

FLAMMABILITY (SOLID, GAS): NOT AVAILABLE

EXPLOSIVE PROPERTIES: NOT TO BE EXPECTED

OXIDISING PROPERTIES: NOT TO BE EXPECTED

VAPOR PRESSURE: @ 68 DEG. F (20 DEG. C) <0.008 MM HG (<1013 HPA)

RELATIVE DENSITY: 1.262 @ 25/25 DEG. C

FREEZING POINT: NOT AVAILABLE

MELTING POINT: APPROX. 64.4 DEG. F (APPROX. 18 DEG. C) (SOLIDIFIES AT A MUCH LOWER TEMPERATURE)

SOLUBILITY: WATER SOLUBILITY: COMPLETE @ 72 DEG. F

FAT SOLUBILITY (SOLVENT-OIL TO BE SPECIFIED): MISCIBLE WITH ETHANOL SLIGHTLY SOLUBLE IN ACETONE INSOLUBLE IN ETHER AND IN CHLOROFORM

PARTITION COEFFICIENT (LOG POW) (CALCULATED): -2.6

VISCOSITY: APPROX. 1300 MPA.S AT 20 DEG. C

VAPOR DENSITY: NOT AVAILABLE

EVAPORATION RATE (NEUOAC=1): NOT AVAILABLE

EXPLOSIVE LIMITS: NOT APPLICABLE

AUTO IGNITION TEMPERATURE: APPROX. 752 DEG. F (APPROX. 400 DEG. C)

COEFFICIENT OF WATER/OIL DISTRIBUTION: NOT AVAILABLE

10. STABILITY AND REACTIVITY

STABILITY: STABLE UNDER NORMAL OPERATIONAL PROCEDURES.

CONDITIONS TO AVOID: NONE IDENTIFIED.

MATERIALS TO AVOID: CONTACT OF GLYCERINE WITH STRONG OXIDIZING AGENTS SUCH AS NITRIC ACID OR OTHER STRONG ACIDS, CHROMIUM TRIOXIDE, POTASSIUM CHLORATE, OR POTASSIUM PERMANGANATE MAY CAUSE AN EXPLOSION.

HAZARDOUS DECOMPOSITION PRODUCTS: DOES NOT DECOMPOSE UP TO 204 DEG. C (400 DEG. F) THERMAL DECOMPOSITION MAY RELEASE ACROLEIN.

HAZARDOUS POLYMERIZATION: NO HAZARDOUS POLYMERIZATION REACTIONS.

11. TOXICOLOGICAL INFORMATION

IRRITATION DATA: SKIN, RABBIT: NOT IRRITATING EYE, RABBIT: NOT IRRITATING

TOXICITY DATA: LD50 ORAL, RAT: >2 G/KG

12. ECOLOGICAL INFORMATION

ECOTOXICITY: CARASSIUS AURATUS (GOLDFISH): 24H LC50 >5,000 MG/L LEUCISCUS IDUS (GOLDEN ORFE): 48H LC0 >250 MG/L

ONCORHYNCHUS MYKISS (RAINBOW TROUT): 96H LC100 = 51,000-57,000 MG/L DAPHNIA MAGNA: 24H EC50 >10,000 MG/L DAPHNIA MAGNA: 24H ECO >500 MG/L

MICROORGANISMS: CHLIMONAS PARAMAECIUM: 48H NOEC >10,000 MG/L ENTOSIPHON SULCATUM: 72H NOEC 3200 MG/L PSEUDOMONAS PUTIDA: 16H NOEC >10,000 MG/L URONEMA PARDUZCI: 20H NOEC >10,000 MG/L

ALGAE: MICROCYSTIS AERUGINOSA: 8D NOEC 2900 MG/L SCYNEDESMUS QUADRICAUDA: 8D ECO >10,000 MG/L

MOBILITY: LOW POTENTIAL FOR SORPTION TO SOIL. GLYCEROL WILL PARTITION PRIMARILY TO WATER.

PERSISTANCE AND DEGRADABILITY: READILY BIODEGRADABLE (OECD 301)

BIOACCUMULATIVE POTENTIAL: BCF: 3.162 (CALCULATED)

13. DISPOSAL CONSIDERATIONS

DISPOSAL IS TO BE PERFORMED IN COMPLIANCE WITH ALL FEDERAL, STATE/PROVINCIAL AND LOCAL REGULATIONS. DO NOT DISPOSE OF VIA SINKS, DRAINS OR INTO THE IMMEDIATE ENVIRONMENT.

14. TRANSPORT INFORMATION

U.S. DOT: NOT REGULATED FOR TRANSPORT NOT CLASSIFIED IN RID/ADR - IMDG - ICAO/IATA

15. ADDITIONAL REGULATORY INFORMATION

INVENTORY STATUS: TSCA, EINECS, DSL, JAPAN, AUSTR, PHIL, CHINA, KOREA WGK WATER ENDANGERING CLASS: 1, LOW HAZARD TO WATER

EU CLASSIFICATION: THIS PRODUCT IS NOT CLASSIFIED AS DANGEROUS ACCORDING TO DIRECTIVE 67/548/EEC.

CANADA:

HAZARDOUS INGREDIENTS - WHMIS (CANADIAN WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM): THIS PRODUCT WHEN TESTED AS A WHOLE IS NOT A CONTROLLED SUBSTANCE WITHIN THE MEANING OF THE HAZARDOUS PRODUCTS ACT.

THIS PRODUCT HAS BEEN CLASSIFIED IN ACCORDANCE WITH THE HAZARD CRITERIA OF THE CONTROLLED PRODUCTS REGULATIONS AND THE MSDS CONTAINS ALL THE INFORMATION REQUIRED BY THE CONTROLLED PRODUCTS REGULATIONS.

16. OTHER INFORMATION

EUROPE: THIS PRODUCT SAFETY DATA SHEET WAS PREPARED IN COMPLIANCE WITH DIRECTIVE 2001/58/EC

REFERENCES: BIBRA TOXICITY PROFILE (1987). GLYCEROL.

OECD SIDS INITIAL ASSESSMENT REPORT FOR SIAM 14, FEBRUARY 2002

THE FOLLOWING SECTIONS CONTAIN REVISIONS OR NEW STATEMENTS: 1.

DEPARTMENT ISSUING MSDS: PRODUCT SAFETY AND REGULATORY AFFAIRS 1-800-477-8899

THE SUBMISSION OF THE MSDS MAY BE REQUIRED BY LAW, BUT THIS IS NOT AN ASSERTION THAT THE SUBSTANCE IS HAZARDOUS WHEN USED IN ACCORDANCE WITH PROPER SAFETY PRACTICES AND NORMAL HANDLING PROCEDURES. DATA SUPPLIED ARE FOR USE ONLY IN CONNECTION WITH OCCUPATIONAL SAFETY AND HEALTH.

THE INFORMATION CONTAINED HEREIN HAS BEEN COMPILED FROM SOURCES CONSIDERED BY PROCTER & GAMBLE TO BE DEPENDABLE AND IS ACCURATE TO THE BEST OF THE COMPANY'S KNOWLEDGE. THE INFORMATION RELATES TO THE SPECIFIC PRODUCT DESIGNATED HEREIN, AND DOES NOT RELATE TO USE IN COMBINATION WITH ANY OTHER MATERIAL OR ANY OTHER PROCESS. PROCTER & GAMBLE ASSUMES NO RESPONSIBILITY FOR INJURY TO THE RECIPIENT OR THIRD PERSONS, OR FOR ANY DAMAGE TO ANY PROPERTY RESULTING FROM MISUSE OF THE CONTROLLED PRODUCT.

NAME: MOON GLYCERINE USP, FCC MOON KOSHER GLYCERINE USP, FCC

MATERIAL SAFETY DATA SHEET

Product Trade Name: **QUIK-GEL®**

Revision Date: 09/04/2002

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Trade Name: QUIK-GEL®

Synonyms: None

Chemical Family: Mineral

Application: Viscosifier

Manufacturer/Supplier Baroid Drilling Fluids
a Product Service Line of Halliburton Energy Services, Inc.
P.O. Box 1675
Houston, TX 77251
Telephone: (281) 871-4000
Emergency Telephone: (800) 666-9260 or (713) 676-3000

Prepared By Product Stewardship
Telephone: 1-580-251-4335

2. COMPOSITION/INFORMATION ON INGREDIENTS
--

SUBSTANCE	CAS Number	PERCENT	ACGIH TLV-TWA	OSHA PEL-TWA
Bentonite	1302-78-9	60 - 100%	Not applicable	Not applicable
Crystalline silica, quartz	14808-60-7	1 - 5%	0.05 mg/m ³	10 mg/m ³ %SiO ₂ + 2
Crystalline silica, cristobalite	14464-46-1	0 - 1%	0.05 mg/m ³	1/2 x 10 mg/m ³ %SiO ₂ + 2
Crystalline silica, tridymite	15468-32-3	0 - 1%	0.05 mg/m ³	1/2 x 10 mg/m ³ %SiO ₂ + 2

More restrictive exposure limits may be enforced by some states, agencies, or other authorities.

3. HAZARDS IDENTIFICATION

Hazard Overview

CAUTION! - ACUTE HEALTH HAZARD

May cause eye and respiratory irritation.

DANGER! - CHRONIC HEALTH HAZARD

Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposures below recommended exposure limits. Wear a NIOSH certified, European Standard En 149, or equivalent respirator when using this product. Review the Material Safety Data Sheet (MSDS) for this product, which has been provided to your employer.

4. FIRST AID MEASURES

Inhalation	If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.
Skin	Wash with soap and water. Get medical attention if irritation persists.
Eyes	In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.
Ingestion	Under normal conditions, first aid procedures are not required.
Notes to Physician	Treat symptomatically.

5. FIRE FIGHTING MEASURES

Flash Point/Range (F):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (F):	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined

Fire Extinguishing Media All standard firefighting media.

Special Exposure Hazards Not applicable.

Special Protective Equipment for Fire-Fighters Not applicable.

NFPA Ratings: Health 0, Flammability 0, Reactivity 0
HMS Ratings: Flammability 0, Reactivity 0, Health 0*

6. ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures Use appropriate protective equipment. Avoid creating and breathing dust.

Environmental Precautionary Measures None known.

Procedure for Cleaning/Absorption Collect using dustless method and hold for appropriate disposal. Consider possible toxic or fire hazards associated with contaminating substances and use appropriate methods for collection, storage and disposal.

7. HANDLING AND STORAGE

Handling Precautions	This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH certified, European Standard En 149, or equivalent respirator when using this product. Material is slippery when wet.
Storage Information	Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls	Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits listed in Section 2.
Respiratory Protection	Wear a NIOSH certified, European Standard En 149, or equivalent respirator when using this product.
Hand Protection	Normal work gloves.
Skin Protection	Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.
Eye Protection	Wear safety glasses or goggles to protect against exposure.
Other Precautions	None known.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Powder
Color:	Various
Odor:	Mild earthy
pH:	8-10
Specific Gravity @ 20 C (Water=1):	2.6
Density @ 20 C (lbs./gallon):	Not Determined
Bulk Density @ 20 C (lbs/ft3):	47.6 (uncompacted) 72.1 (compacted)
Boiling Point/Range (F):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (F):	Not Determined
Freezing Point/Range (C):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Slightly soluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (lbs./gallon):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistrokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid	None anticipated
Incompatibility (Materials to Avoid)	Hydrofluoric acid.
Hazardous Decomposition Products	Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye or skin contact, inhalation.
Inhalation	<p>Inhaled crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (IARC, Group 1). There is sufficient evidence in experimental animals for the carcinogenicity of tridymite (IARC, Group 2A).</p> <p>Breathing silica dust may cause irritation of the nose, throat, and respiratory passages. Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may also have serious chronic health effects (See "Chronic Effects/Carcinogenicity" subsection below).</p>
Skin Contact	May cause mechanical skin irritation.
Eye Contact	May cause eye irritation.
Ingestion	None known
Aggravated Medical Conditions	Individuals with respiratory disease, including but not limited to asthma and bronchitis, or subject to eye irritation, should not be exposed to quartz dust.
Chronic Effects/Carcinogenicity	<p>Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis.</p> <p>Cancer Status: The International Agency for Research on Cancer (IARC) has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources can cause lung cancer in humans (Group 1 - carcinogenic to humans) and has determined that there is sufficient evidence in experimental animals for the carcinogenicity of tridymite (Group 2A - possible carcinogen to humans). Refer to <u>IARC Monograph 68, Silica, Some Silicates and Organic Fibres</u> (June 1997) in conjunction with the use of these minerals. The National Toxicology Program classifies respirable crystalline silica as "Known to be a human carcinogen". Refer to the 9th Report on Carcinogens (2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2).</p> <p>There is some evidence that breathing respirable crystalline silica or the disease silicosis is associated with an increased incidence of significant disease endpoints such as scleroderma (an immune system disorder manifested by scarring of the lungs, skin, and other internal organs) and kidney disease.</p>

Other Information

For further information consult "Adverse Effects of Crystalline Silica Exposure" published by the American Thoracic Society Medical Section of the American Lung Association, American Journal of Respiratory and Critical Care Medicine, Volume 155, pages 761-768 (1997).

Toxicity Tests

Oral Toxicity: Not determined

Dermal Toxicity: Not determined

Inhalation Toxicity: Not determined

Primary Irritation Effect: Not determined

Carcinogenicity Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997).

Genotoxicity: Not determined

**Reproductive /
Developmental Toxicity:** Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air) Not determined

Persistence/Degradability Not determined

Bio-accumulation Not Determined

Ecotoxicological Information

Acute Fish Toxicity: TLM96: 10000 ppm (Oncorhynchus mykiss)

**Acute Crustaceans
Toxicity:** Not determined

Acute Algae Toxicity: Not determined

Chemical Fate Information Not determined

Other Information Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method Bury in a licensed landfill according to federal, state, and local regulations.

Contaminated Packaging Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION**Land Transportation**

DOT
Not restricted

Canadian TDG
Not restricted

ADR Not restricted

Air Transportation

ICAO/IATA
Not restricted

Sea Transportation

IMDG
Not restricted

Other Shipping Information

Labels: None

15. REGULATORY INFORMATION

US Regulations

US TSCA Inventory	All components listed on inventory.
EPA SARA Title III Extremely Hazardous Substances	Not applicable
EPA SARA (311,312) Hazard Class	Acute Health Hazard Chronic Health Hazard
EPA SARA (313) Chemicals	This product does not contain a toxic chemical for routine annual "Toxic Chemical Release Reporting" under Section 313 (40 CFR 372).
EPA CERCLA/Superfund Reportable Spill Quantity For This Product	Not applicable.
EPA RCRA Hazardous Waste Classification	If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.
California Proposition 65	The California Proposition 65 regulations apply to this product.
MA Right-to-Know Law	One or more components listed.
NJ Right-to-Know Law	One or more components listed.
PA Right-to-Know Law	One or more components listed.

Canadian Regulations

Canadian DSL Inventory	All components listed on inventory.
WHMIS Hazard Class	D2A Very Toxic Materials (Crystalline silica)

16. OTHER INFORMATION

The following sections have been revised since the last issue of this MSDS

Not applicable

Additional Information

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Material Safety Data Sheet for this or other Halliburton products, contact Product Stewardship at 1-580-251-4335.

Disclaimer Statement

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

*****END OF MSDS*****

Material Safety Data Sheet

J. R. Simplot Company

AgriBusiness

Trade Name: Silica Sand

Registration No: None

M80002

SECTION 1

CHEMICAL PRODUCT AND COMPANY INFORMATION

Manufacturer or Formulator: Simplot Silica Products
P.O. Box 308
Overton, NV 89040
Emergency Phone - Chemtrec: 1-800-424-9300

Product Name: Silica Sand
Common Name: Silica Sand
Chemical Type: Not listed

SECTION 2

COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name and Synonyms	C.A.S. No.	Chemical Formula	WT% Hazardous	TLV	PEL
Silica (crystalline)	14808-60-7	SiO ₂	99%	Respirable Dust Quartz: 0.025 mg/m ³ Cristobalite: 0.025 mg/m ³ Tridymite: Not listed	Respirable Dust 10 mg/m ³ / (%SiO ₂ + 2) Use half the value calculated for quartz Use half the value calculated for quartz

Non-Hazardous

None listed

SECTION 3

HAZARDS IDENTIFICATION

Ingestion: Not listed
Inhalation: Potential health effects of inhalation are as follows: *Silicosis* – Respirable crystalline silica (quartz) can cause silicosis, a fibrosis (scarring) of the lungs. Silicosis may be progressive; it may lead to disability and death. *Lung Cancer* – Crystalline silica (quartz) inhaled is classified by IARC as a carcinogen. *Tuberculosis* – Silicosis increases the risk of Tuberculosis. *Autoimmune and Chronic Kidney Disease* – Some studies show excess numbers of cases of scleroderma, connective tissue disorders, lupus, rheumatoid arthritis, chronic kidney diseases and end-stage kidney disease in workers exposed to respirable crystalline silica. *Non-Malignant Respiratory Diseases (other than Silicosis)* – Some studies show an increased incidence in chronic bronchitis and emphysema in workers exposed to respirable crystalline silica.
Eye Contact: Abrasive in eyes.
Skin Absorption: Not available.
Skin Contact: Not available.
Effects of Overdose: Acute Effects: short term exposure to silica may result in mild to temporary discomfort in the respiratory tract (similar to nuisance dust). Short term exposure to excessive amounts of silica may cause severe inflammation of the lungs possibly coupled with fluid in the lungs, resulting in shortness of breath and low blood oxygen levels. Excessive inhalation of crystalline silica in a short time is a serious health concern.
Chronic Effects: long term exposure (10 years - 30 years), may result in pulmonary fibrosis (silicosis). Aggravates bronchitis, asthma and emphysema.

SECTION 4

FIRST AID MEASURES

Ingestion: First aid procedures not normally required. If gastrointestinal discomfort occurs, give 1 or two glasses of water. Seek medical attention if conditions persist.
Inhalation: If there is significant inhalation of crystalline silica (quartz), remove the victim immediately to fresh air, give artificial respiration if victim is not breathing. Seek medical attention if conditions persist.
Eyes: Flush with clean water for at least 15 minutes, avoid rubbing. Seek medical attention if conditions persist.
Skin: Wash with soap and water. If discomfort and/or irritation persist, seek medical attention.

SECTION 5

FIRE FIGHTING MEASURES

Extinguishing Media: Not applicable
Special Fire Fighting Procedures: Not applicable
Unusual Fire and Explosion Hazards: None

SECTION 6

ACCIDENTAL RELEASE MEASURES

Environmental Precautions: None listed

Steps to be taken in case material is released or spilled:

Use dustless methods (vacuum or wetting method) and place into closable container for disposal. Do not dry sweep. Wear protective equipment.

SECTION 7 HANDLING AND STORAGE

Precautions to be taken in handling and storing:

Do not breathe dust. Do not rely on sight to determine the presence of silica dust in the air; silica may be present without a visible dust cloud. Use good housekeeping in storage areas to prevent accumulation of dust. Avoid breakage of bagged material or spills of material. Refer to section 6 in event of bag breakage or spill of material.

Means should be taken to keep silica exposure below the recommended TLV to avoid adverse health effects. If exposure can not be kept below the TLV NIOSH recommends reducing exposure levels as low as possible and substituting less hazardous materials for crystalline silica when feasible. Use appropriate respiratory protection when source controls cannot keep exposures below the recommended exposure level, and making medical examinations available to exposed workers.

Wearing a respirator approved for silica dust can minimize exposure. Use a respirator when handling, storing, or disposing of the product or bag. ANSI Z88.2, OSHA 29 CFR 1910.134, and MSHA 30 CFR Parts 56 and 57 are standard that refer to respiratory protection and the requirements. Maintain, clean, and fit test respirators in accordance with OSHA regulations.

Provide training for employees about OSHA precautions and contents of this MSDS.

For additional information on the hazards of silica dust please view the following links:

- 1) NIOSH Hazard Review-Health Effects of Occupational Exposure to Respirable Crystalline Silica <http://www.cdc.gov/niosh/docs/2002-129/02-129a.html>
- 2) OSHA Silica Dust <http://www.osha.gov/SLTC/silicacrystalline/index.html>
- 3) MSHA Silicosis Prevention <http://www.msha.gov/S&HINFO/SILICO/SILICO.HTM>

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Ventilation Protection: Local exhaust as needed to reduce respirable dust levels below TLV and/or PEL limits.
Respiratory Protection: For guidance when selecting respiratory protection, see the following table developed by NIOSH for suggested protection from respirable crystalline silica (quartz) dust.
Protective Clothing: Normal work clothes.
Eye Protection: Safety glasses with side shields as required.

PARTICULATE CONCENTRATION	MINIMUM RESPIRATORY PROTECTION (use only NIOSH-certified respirators)
10 x PEL or Less	<ul style="list-style-type: none"> ▪ Any dust respirator, except single-use or quarter mask respirator. ▪ A fume respirator or high efficiency particulate filter respirator. ▪ Any supplied-air respirator. ▪ Any self-contained breathing apparatus.
50 x PEL or Less	<ul style="list-style-type: none"> ▪ A high efficiency particulate filter respirator with a full facepiece. ▪ Any supplied-air respirator with a full facepiece, helmet, or hood. ▪ Any self-contained breathing apparatus with a full facepiece.
500 x PEL or Less	<ul style="list-style-type: none"> ▪ A powered air-purifying respirator with a high efficiency particulate filter. ▪ A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode.
Greater than 500 x PEL or Entry and Escape from Unknown Concentrations	<ul style="list-style-type: none"> ▪ Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. ▪ A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.

Respiratory Protection for Crystalline Silica, NIOSH Occupational Health Guideline for Crystalline Silica, Pg. 5

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point: 2230°C	Solubility in Water: None
Density: 110 lbs/ft ³	% Volatiles (by volume): Not listed
Flashpoint: Not applicable	Vapor Pressure, mm Hg: Not applicable
pH: Not listed	Reaction with Water: None
Appearance: Very hard, fine grained particles; white, buff or pink in color; odorless.	
Extinguishing Media: Not applicable. Non-flammable.	

SECTION 10 STABILITY AND REACTIVITY

Stability (Normal Conditions): Stable
Conditions to Avoid: None listed.
Incompatibility (Material to Avoid): CIF₃, MNF₃, OF₂.
Hazardous Decomposition Products: None
Hazardous Polymerization: Will not occur

Trade Name: Silica Sand
Registration No: Not listed

M80002

SECTION 11

TOXICOLOGY INFORMATION

Table of Acute Toxicity Data from the National Library of Medicine Specialized Information Services, 2006

Organism	Test Type	Route	Reported Dose	Effect	Source
Dog	LDLo ¹	Intravenous	20 mg/kg	-	Biochemical Journal. Vol. 27, Pg. 1007, 1933.
Human	LCLo ²	Inhalation	0.3 mg/m ³	LIVER: Other Changes	Annals of the New York Academy of Sciences. Vol. 127, Pg. 324, 1976.
Human	TCLo ³	Inhalation	16 mppcf (million particles per cu. foot)	LUNGS, THORAX, or RESPIRATION: "Fibrosis, Focal (Pneumoconiosis)" LUNGS, THORAX, or RESPIRATION: Cough LUNGS, THORAX, or RESPIRATION: Dyspnea	National Technical Information Service. Vol. PB246-697.
Mouse	LD ⁴	Intratracheal	> 20 mg/kg	LUNGS, THORAX, or RESPIRATION: Other Changes	American Review of Respiratory Disease. Vol. 141(Suppl), Pg. A3-A937, 1990.
Mouse	LDLo ¹	Intravenous	40 mg/kg	-	Journal of the National Cancer Institute. Vol. 1, Pg. 241, 1940.
Rat	LDLo ¹	Intratracheal	200 mg/kg	LUNGS, THORAX, or RESPIRATION: "Fibrosis, Focal (Pneumoconiosis)"	British Journal of Industrial Medicine. Vol. 10, Pg. 9, 1953.
Rat	LDLo ¹	Intravenous	90 mg/kg	-	Journal the National Cancer Institute. Vol. 57, Pg. 509, 1976.

¹LDLo – (Lethal Dose Low), the lowest dose of material to cause death in the organism.

²LCLo – (Lethal Concentration Low), the lowest concentration of material in air at which death occurs. (Gases, mists, dusts, or vapors)

³TCLo – (Toxic Concentration Low), the lowest concentration of a material in air at which toxic effects are observed. (Gases, mists, dusts, or vapors)

⁴LD – (Lethal Dose), the dose at which lethality occurs in the single test organism.

SECTION 12

ECOLOGICAL INFORMATION

None listed.

SECTION 13

DISPOSAL CONSIDERATIONS

Waste Disposal Procedures: May be land filled according to local, state and federal regulations.

SECTION 14

TRANSPORT INFORMATION-

Shipping name:	Not regulated by D.O.T.	C.A.S. Number:	14808-60-7
Hazard Class:	Not listed	D.O.T. Number:	Not listed
Reportable Quantity (RQ):	Not listed	Haz Waste No:	Not listed
Labels Required:	Not listed	EPA Regist No:	Not listed
Placard:	Not listed		

SECTION 15

REGULATORY INFORMATION

Carcinogenicity: by IARC?: Yes (X) No () by NTP?: Yes (X) No ()
IARC (International Agency for Research on Cancer) classifies crystalline silica in Group 1, "known human carcinogen."
NTP (National Toxicology Program) classifies respirable crystalline silica in a category of substances which is "known to be a human carcinogen."

California Prop 65: Yes (X) No ()
Silica, crystalline (airborne particles of respirable size), is cited in 90 California Reg. Notice 984, Safe Drinking Water and Enforcement Act of 1986, as known to the state of California to cause cancer.

Not on the 302 list of SARA reportable quantities.

SECTION 16

OTHER INFORMATION

Flash Point (Test Method):	Non-flammable	Flammable Limits	LOWER	UPPER
Autoignition Temperature:	Not applicable	(% BY VOLUME)	N/A	N/A

Hazard Rating (N.F.P.A.): Health: 1 Fire: 0 Reactivity: 0 Specific: Not applicable
This N.F.P.A. rating is a recommendation by the manufacturer using the guidelines or published evaluations prepared by the National Fire Protection Association (N.F.P.A.).

MSDS Version Number: 7 (revisions to Section 7)

Disclaimer: This information relates to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is to the best of our knowledge and belief, accurate and reliable as of the date compiled. However, no representation, warranty or guarantee is made as to its accuracy, reliability or completeness. **NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, IS MADE CONCERNING THE INFORMATION HEREIN PROVIDED.** It is the user's responsibility to satisfy himself as to the suitability and completeness of such information for his own particular use. We do not accept liability for any loss or damage that may occur from the use of this information nor do we offer warranty against patent infringement.

Reviewed By: The Environmental Health & Safety Department
June 2009 (208) 389-7394

BACHARACH99-0095
Rev. 2
11/28/89**Material Safety Data Sheet**Thermometer, Red Spirit Filled
12-0052, 12-0266, 12-7012
QUICK IDENTIFIER (In Plant Common Name)

Manufacturer's Name	BACHARACH, INC.	Emergency Telephone No.	(412) 963-2000
Address	825 ALPHA DR. PITTSBURGH, PA. 15238	Other Information Calls	(412) 963-2223
Signature of Person Responsible for Preparation	<i>Robert L. Mporok</i>	Date Prepared	12/1/89

SECTION 1 - IDENTITY

Common Name (used on label) (Trade Name & Synonym)	Red liquid in glass thermometers	Cas No.	8008-20-6
Chemical Name	Hydrocarbon (Kerosene)	Chemical Family	Hydrocarbon in Petrochemicals
Formula	C(n)H(m)		

SECTION 2 - HAZARDOUS INGREDIENTS

Principal Hazardous Component(s) (chemical & common name(s))	CAS#	%	Threshold Limit Value (msd)
Kerosene	8008-20-6	100%	100 mg/m ³ NIOSH 10 hr. limit

Not subject to SARA Section 313 annual toxic chemical release reporting.

SECTION 3 - PHYSICAL & CHEMICAL CHARACTERISTICS (Fire & Explosion Data)

Boiling Point	150 ^o -250 ^o C	Specific Gravity (H ₂ O=1)	0.790	Vapor Pressure (mm Hg)	5 mmHg at 38 ^o C
Percent Volatile by Volume (%)	Unknown	Vapor Density (Air = 1)	4.5	Evaporation Rate	Unknown
Solubility in Water	Insoluble	Reactivity in Water	None		
Appearance and Odor	Transparent liquid. Oily odor.				
Flash Point	40 ^o C	Flammable Limits in Air % by Volume	Lower 0.7 Upper 5	Extinguisher Media	CO ₂
Special Fire Fighting Procedures	Dry chemical extinguisher, foam CO ₂				
Auto-Ignition Temperature	255 ^o C				

Unusual Fire and Explosion Hazards	Moderate when exposed to heat or flame.
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SECTION 4 - PHYSICAL HAZARDS

Stability Unstable Stable Conditions to Avoid Glass - Do not break.

Incompatibility Materials to Avoid Can react with oxidizing materials.

Hazardous Decomposition Products None.

Hazardous Polymerization May Occur Will Not Occur Conditions to Avoid Contact with strong oxidizers.

SECTION 5 - HEALTH HAZARDS

Threshold Limit Value 100mg/m³

Signs and Symptoms of Exposure 1. Acute Overexposure Unknown

2. Chronic Overexposure May cause mucous membrane irritation.

Medical Conditions Generally Aggravated by Exposure May cause dryness, irritation, dermatitis and edema.

Chemical Listed as Carcinogen or Potential Carcinogen	None	National Toxicology Program	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	I.A.R.C. Monographs	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	OSHA	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
			N/A		N/A		N/A

OSHA Permissible Exposure Limit	N/A	ACGIH Threshold Limit Value	N/A	Other Exposure Limit Used	None.
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Emergency and First Aid Procedures

ROUTES OF ENTRY	1. Inhalation	Inhale fresh air.
	2. Eyes	Wash out with water or boric acid solution & then consult physician.
	3. Skin	Wash well and apply skin cream.
	4. Ingestion	Immediately induce vomiting. Consult physician.

SECTION 6 - SPECIAL PROTECTION INFORMATION

Respiratory Protection (Specify Type) Type C supplied - air or self contained breathing apparatus.

Ventilation	Required	Local Exhaust	Required	Mechanical (General)	N/A	Special	N/A	Other	N/A
-------------	----------	---------------	----------	----------------------	-----	---------	-----	-------	-----

Protective Gloves Required Eye Protection Required

Other Protective Clothing or Equipment Wear oil impervious clothing. Avoid prolonged contact.

SECTION 7 - SPECIAL PRECAUTIONS AND SPILL/LEAK PROCEDURES

Precautions to be Taken in Handling and Storage Avoid direct sunlight. Store in accordance with 29 CFR 1910.106.

Other Precautions Use in well ventilated area.

Steps to be Taken in Case Material is Released or Spilled Soak up with "Oil Dry".

Waste Disposal Methods Incinerate properly.

IMPORTANT

Do not leave any blank spaces. If required information is unavailable, unknown, or does not apply, so indicate.



CAMEO Chemicals

 [Print](#)

Chemical Datasheet

TURPENTINE SUBSTITUTE

4
1 0

Chemical Identifiers

UN/NA Number	CAS Number	CHRIS Code	DOT Hazard Label
1300	64475-85-0	MNS	FLAMMABLE LIQUID
NFPA 704: Red 4 -- Flammability: Extremely flammable Blue 1 -- Health Hazard: Slightly hazardous Yellow 0 -- Reactivity: Normally stable			

General Description

A clear colorless to variably colored liquid. Insoluble in water. Flash point between 100 and 141°F.

Hazards

Reactivity Alerts

none

Air & Water Reactions

Flammable. Insoluble in water.

Fire Hazard

HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks). Vapor explosion hazard indoors, outdoors or in sewers. Runoff to sewer may create fire or explosion hazard. Containers may explode when heated. Many liquids are lighter than water. Substance may be transported hot. If molten aluminum is involved, refer to GUIDE 169 below.

GUIDE 169: Substance is transported in molten form at a temperature above 705° C (1300° F). Violent reaction with water; contact may cause an explosion or may produce a flammable gas. Will ignite combustible materials (wood, paper, oil, debris, etc.). Contact with nitrates or other oxidizers may cause an explosion. Contact with containers or other materials, including cold, wet or dirty tools, may cause an explosion. Contact with concrete will cause spalling and small pops. (ERG, 2008)

Health Hazard

INHALATION: mild irritation of respiratory tract. **ASPIRATION:** severe lung irritation and rapidly developing pulmonary edema; central nervous system excitement followed by depression. **INGESTION:** irritation of

stomach. (USCG, 1999)

Reactivity Profile

TURPENTINE SUBSTITUTE may react vigorously with strong oxidizing agents.

Belongs to the Following Reactive Group(s)

- Hydrocarbons, Aliphatic Unsaturated

Response Recommendations

Firefighting

Do not extinguish fire unless flow can be stopped. Use water in flooding quantities as fog. Use foam, dry chemical, or carbon dioxide. Keep run-off water out of sewers and water sources. Cool all affected containers with flooding quantities of water. Apply water from as far a distance as possible. (AAR, 2003)

Non-Fire Response

Keep material out of water sources and sewers. Build dikes to contain flow as necessary. Attempt to stop leak if without undue personnel hazard. (AAR, 2003)

Protective Clothing

Plastic gloves; goggles or face shield (as for gasoline). (USCG, 1999)

_____ Dupont Average Standardized Breakthrough Times _____
(for MINERAL SPIRITS)

Tychem® BR

greater than 480 min. (concentration: 95+%)

Tychem® CPF2

greater than 480 min. (concentration: 95+%)

Tychem® CPF4

greater than 480 min. (concentration: 95+%)

Tychem® LV

greater than 480 min. (concentration: 95+%)

Tychem® QC

immediate (less than 10 min.) (concentration: 95+%)

Tychem® QC for Corrections

immediate (less than 10 min.) (concentration: 95+%)

Tychem® Reflector®

greater than 480 min. (concentration: 95+%)

Tychem® Responder®

greater than 480 min.

Tychem® Responder® CSM

greater than 480 min.

Tychem® SL

greater than 480 min. (concentration: 95+%)

Tychem® TK

greater than 480 min. (concentration: 95+%) (DuPont, 2008)

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First Aid

INHALATION: remove victim to fresh air.

ASPIRATION: enforce bed rest; give oxygen; call a doctor.

INGESTION: do NOT induce vomiting; guard against aspiration into lungs.

EYES: wash with copious amounts of water.

SKIN: wipe off and wash with soap and water. (USCG, 1999)

Physical Properties

Molecular Formula: data unavailable

Flash Point: 105 to 140 ° F depending on grade (USCG, 1999)

Lower Explosive Limit: 0.8 % (USCG, 1999)

Upper Explosive Limit: 5.0 % (USCG, 1999)

Autoignition Temperature: 540.0 ° F (USCG, 1999)

Melting Point: data unavailable

Vapor Pressure: 6.72 mm Hg (USCG, 1999)

Vapor Density: data unavailable

Specific Gravity: 0.78 at 68.0 ° F (USCG, 1999)

Boiling Point: 310 to 395 ° F at 760.0 mm Hg (USCG, 1999)

Molecular Weight: data unavailable

Water Solubility: data unavailable

AEGL: data unavailable

ERPG: data unavailable

TEEL-1

60.0 ppm

(SCAPA, 2008)

TEEL-2

400.0 ppm

TEEL-3

2000.0 ppm

IDLH: data unavailable

Regulatory Information

Regulatory Names: none

CAA RMP: Not a regulated chemical.

CERCLA: Not a regulated chemical.

EHS (EPCRA 302): Not a regulated chemical.

TRI (EPCRA 313): Not a regulated chemical.

RCRA Chemical Code: none

Alternate Chemical Names

- AMSCO 140
- COASTAL PALE OIL 105
- COATING MATERIALS, VEHICLES, PETROLEUM SPIRITS
- ESSENCE DE TÉRÉBENTHINE, SUCCÉDANÉ D' (DOT FRENCH)
- LAWS
- LAWS (SOLVENT)
- MINERAL SPIRITS
- NAPHTHA
- NAPHTHA, PETROLEUM SPIRITS
- PETROLEUM SPIRITS
- SHELLSOL 340
- SOLTROL
- SOLTROL 100
- SOLTROL 180
- SOLTROL 220
- SOLTROL 50
- SOLVENT 140
- SPIRITS
- SUBSTITUTO DE TREMENTINA (DOT SPANISH)
- TERLITOL 16/18
- TURPENTINE SUBSTITUTES
- VARSOL 40
- WHITE SPIRITS

APPENDIX J
SHSO SUMMARY

APPENDIX J
SHSO SUMMARY

To be completed by SHSO following completion of each phase of field work.

During the work covered by this Site Specific Health and Safety Plan, there were:

(check one)

_____ No violations of the Safety Plan provisions and no incidents involving injury, illness or personnel contamination.

_____ The following violations of the Safety plan provisions or incidents involving injury, illness or personnel contamination occurred. (Provide details of type of violation or incident, who was involved, circumstances, and first aid or medical treatment required.)

If violation or incident occurred, describe corrective actions taken to prevent reoccurrence.

Project/Task Name: _____

Project/Task Number: _____

Dates in Field: _____

Signature: _____

(SHSO)

Date: _____

APPENDIX K

LEAD MEDICAL MONITORING PLAN

APPENDIX K LEAD MEDICAL MONITORING PLAN

AMEC has developed this Lead Medical Monitoring Plan to supplement the Site Specific Health and Safety Plan developed for the Lake Linden – Calumet and Hecla Power Plant Site in Torch Lake Township, Houghton County, Michigan (Site). This plan was developed to address all work performed at the Site and most importantly within areas identified or known to contain lead in soil exceeding 1,700 milligrams per kilogram (mg/kg). A figure showing general site features and known areas containing lead contamination in soils exceeding 1,700 mg/kg are shown on Figure K-1.

BREATHING ZONE DUST MONITORING

Breathing zone dust monitoring will be performed to evaluate the total amount of nuisance dust generated on a daily basis and per work task basis. Dust monitoring will be conducted using a respirable dust meter. Dust meter readings will be collected at a minimal of two readings per hour for all onsite work and four times per hour for the first day of all new work. Dust monitoring will be collected in the breathing zone and at the location most likely to generate dust. Dust monitoring readings will be compared to site-specific action levels based on the known concentrations of lead in near surface soils. If dust monitoring readings exceed action levels, dust suppression methods will be required. If dust suppression methods do not reduce dust readings below action levels workers will need to upgrade to Level C Personal Protective Equipment (PPE) and begin personal monitoring. Dust monitoring readings will be recorded on Dust Monitoring Record Sheets. The dust monitoring action levels are summarized in Table K-1.

PERSONAL MONITORING

Personal monitoring will be undertaken to characterize the personal exposure of high-risk employees to the hazardous substances they may encounter on-site. Personal monitoring will be conducted on a representative basis and personnel who are represented by the sampling will be noted in a site-specific log book and/or field logs.

The following personal monitoring equipment will be used at the Site.

- (1) Gillian pump, with 37 mm two or three piece, mixed cellulose ester cassettes with 0.8-micron pore size.

Personal monitoring will be undertaken to characterize the worker exposure to lead through the monitoring of representative employees. Employee selection will be based on work task and duration of exposure. Sampling will be representative of a full shift and will include at least one sample for each job classification in each area. Sampling and analysis will be done in accordance

with NIOSH methodology that is summarized below. Contact Cindy Sundquist, CIH, CSP, Regional HSE Manager, prior to sampling.

1. One worker per task per job classification will be selected. The worker selected will be the one thought to have the greatest exposure for the longest duration (if two workers have equal exposures, personal monitoring can be rotated if sampling is to be conducted on more than one day). The exposures to all other workers will assumed to be the same as the chosen individual, or lower. Record the name, social security number, job classification, and company of all workers for whom the sample represents plus record the date(s), number, duration, and location, of each of the samples taken, including a description of the sampling procedure used to determine representative employee exposure where applicable. Record the type of respiratory protection devices worn, if any, and any environmental variables (e.g., rain, mist, snow, wind, temperature) that could affect the measurement of employee exposure.
2. Full shift (at least 7 hours) breathing zone samples will be conducted using personal sampling pumps, calibrated before and after each use, and set at 2 liters per minute. Minimum sample volume is 200 liters. Two or three piece mixed cellulose-ester filters with 0.8-micrometer pore size and 37 mm diameter will be used to collect the.
3. Collect samples, closed face, and ship together along with one open and one closed blank. Open blanks are filter cassettes that are handled in the same manner that the samples are, except that no air is drawn through them (e.g., remove the end plugs and store until sampling is complete, then replace the plugs.) Closed blanks are media blanks to ensure that the cassettes were not contaminated prior to sampling. Samples should be analyzed using NIOSH method 7082 (Atomic Absorption).
4. At least one sample per task per site location will be taken in the initial monitoring phase. If the results show lead levels below 0.03 mg/m^3 , no further testing will be required in that area for that task. If levels are found to be above 0.03 mg/m^3 , repeat testing may be needed if task duration is longer than 3 months. If conditions or tasks change that may result in new or additional exposures to lead, additional samples will be taken.
5. Notify all affected workers (both AMEC and subcontractor personnel), in writing, of the results of the analysis within 5 working days of their receipt. Affected workers include not only the worker wearing the pump and filter, but also the others working in the same general area as well.

OTHER REQUIREMENTS

Engineering controls, whenever feasible, shall be used.

Respirators:

Full face, cartridge respirators with an N, P or R 100 filter shall be used if there is a potential for lead levels to be above the action limit. If organics are present which require upgrade to level C PPE, use cartridge also capable of filtering organics as well.

Worst-case exposure modeling was conducted. As a result, AMEC could not rule out the potential for lead levels in the breathing zone to be above the OSHA action limit of 0.03 mg/m³. Based on the varying known lead levels present at the Site, various action limits have been developed for the respirable decimeter to upgrade to Level C PPE (Table K-1).

Upgrade to level B PPE is required when respirable dust readings reach or exceed 1.6 mg/m³ in areas containing known elevated levels of lead (table K-1). It is at this level where there is a potential for lead levels to exceed the OSHA maximum use concentration for lead when using a full-face cartridge respirator.

All workers who wear a cartridge respirator must have been fit-tested within the last year.

Monitoring:

Use respirable decimeter (or total dust meter if workers will be working directly in a dust cloud). Base action levels on maximum soil concentrations (Table K-1).

Decontamination:

Place a sign near the decontamination station is and/or where equipment is decontaminated that states **CAUTION: CLOTHING CONTAMINATED WITH LEAD. DO NOT REMOVE DUST BY BLOWING OR SHAKING. DISPOSE OF LEAD CONTAMINATED WASH WATER IN ACCORDANCE WITH APPLICABLE LOCAL, STATE, OR FEDERAL REGULATIONS.**

All workers **MUST** shower at the end of the workday if there is a potential for lead levels to be above the PEL (Level C PPE is worn).

Medical Surveillance:

Blood lead analysis (lead and zinc protoporphyrin levels) shall be conducted before working in areas with high lead contamination levels, or a potential for high lead levels, where the work conducted could result in levels above the PEL, as well as after their work at the site has been completed.

All workers will be notified, in writing, of the results of the biological monitoring within 5 working days. (NOTE: blood levels in excess of 30 mg/100 g of whole blood require removal from work involving lead exposures.)

Training:

All workers with a potential for exposure to lead at any level must receive the following training:

1. Lead exposures according to the requirements of the Hazard Communication Standard in Construction (29 CFR 1926.56), including warning signs and labels, MSDSs, and employee information and training.

All workers with a potential exposure to lead at or above the action limit of 0.03 mg/m³ must receive the following training:

1. The contents of the standard (29 CFR 1926.62) and its appendices.
2. The specific nature of the operations that could result in exposure to lead above the action limits.
3. The purpose of the medical surveillance program in regards to monitoring for lead. Information must include the adverse health effects associated with excessive exposure to lead (especially reproductive effects).
4. The engineering controls (if any) and work practices (e.g., wetting soil to control dust) to be used at the site.
5. Instructions that chelating agents should not be used to remove lead from their bodies except under the direction of a licensed physician. (NOTE: Chelating agents remove metals from the body by binding to the metal, making it soluble so that it can be excreted in the urine. The problem with them is that they are indiscriminate and remove essential metals from the body as well. Chelation is a last resort to be used only when extremely high lead levels are found in the blood.)
6. Inform workers that copies of the standard and its appendices are available to them if interested.
7. The contents of any compliance plan.
8. The employees right of access to records under 29 CFR 1910.1020.

Signs:

The following sign must be posted at the entrance to any area with a potential for lead levels to exceed the PEL.

**WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING**

Recordkeeping:

AMEC is required to maintain records of all monitoring conducted in regards to lead, therefore, a copy of the results of the monitoring must be placed in the employee file and also a copy sent to Cindy Sundquist. In addition to the results, the following information must also be provided:

1. Dates, number, duration, location and results of each of the samples taken. Included with this must be a description of the sampling procedures used to determine representative employee exposure where applicable.
2. A description of the sampling and analytical methods used and evidence of their accuracy.
3. The type of respiratory protective devices worn, if any.
4. The Name, social security number, company, and job classification of the employees monitored and all other employees (or subcontractors) for whom the sample represents.
5. The environmental variables that could affect the measurement of employee exposure (e.g., cold weather, ground frozen, no wind; vs. warm day, soil dry, windy)

NOTE: These records will be maintained for duration of employment plus 30.
Medical surveillance records will also be maintained for the same duration.
All records will be made available to associates, upon request.

TABLE K-1 - DUST MONITORING ACTION LEVEL SUMMARY
Lead Medical Monitoring Plan
Lake Linden - Calumet and Hecla Power Plant Site
Torch Lake Township, Michigan

DUST METER ACTION LEVEL (mg/m3)	LEAD CONCENTRATION IN SOIL ¹ (mg/kg)	ACTION	LEVEL OF PPE REQUIRED
> 1.5	≥ 1,700	Cease work and implement dust suppression methods. Continue dust monitoring and if dust suppression methods fail, cease work, begin lead medical monitoring, and upgrade to Level B PPE.	LEVEL B
> 0.16	≥ 70,000	Cease work and implement dust suppression methods. Continue dust monitoring and if dust suppression methods fail, cease work, begin lead medical monitoring, and upgrade to Level C PPE.	LEVEL C
≥ 0.70	≥ 12,000	Cease work and implement dust suppression methods. Continue dust monitoring and if dust suppression methods fail, cease work, begin lead medical monitoring, and upgrade to Level C PPE.	LEVEL C
≥ 1.5	≥ 1,700	Cease work and implement dust suppression methods. Continue dust monitoring and if dust suppression methods fail, cease work, begin lead medical monitoring, and upgrade to Level C PPE.	LEVEL C
< 1.5	< 1,700	Continue dust monitoring in Level D PPE.	LEVEL D

NOTES:

¹ Lead concentrations in soil as reported by the USEPA.

mg/m3- milligrams per cubic meter

mg/kg - milligrams per kilogram

PPE - Personal Protective Equipment



Source: NAIP, 2010

Legend

- Fence
- Gate
- Approximate Property Boundary

- Lead Monitoring Area
- Berm
- Gravel Road

Soil Analytical Results for Lead at 6 XRF Locals

- <DCC
- 1,700 ppm
- 12,000 ppm
- 70,000 ppm

DCC – State of Michigan Residential Direct Contact Criteria of 400 ppm (March 2011)
ppm – parts per million



Prepared By: BSM
Checked By: DRS

Approved By:
Date: 8/18/2011

**Figure K-1
Lead Medical Monitoring Plan**

Former C & H POWER PLANT SITE
LAKE LINDEN,
HOUGHTON COUNTY, MICHIGAN
Project 3293-11-1440

TABLE K-1 - DUST MONITORING ACTION LEVEL SUMMARY
Lead Medical Monitoring Plan
Lake Linden - Calumet and Hecla Power Plant Site
Torch Lake Township, Michigan

DUST METER ACTION LEVEL (mg/m3)	LEAD CONCENTRATION IN SOIL¹ (mg/kg)	ACTION	LEVEL OF PPE REQUIRED
> 1.5	≥ 1,700	Cease work and implement dust suppression methods. Continue dust monitoring and if dust suppression methods fail, cease work, begin lead medical monitoring, and upgrade to Level B PPE.	LEVEL B
> 0.16	≥ 70,000	Cease work and implement dust suppression methods. Continue dust monitoring and if dust suppression methods fail, cease work, begin lead medical monitoring, and upgrade to Level C PPE.	LEVEL C
≥ 0.70	≥ 12,000	Cease work and implement dust suppression methods. Continue dust monitoring and if dust suppression methods fail, cease work, begin lead medical monitoring, and upgrade to Level C PPE.	LEVEL C
≥ 1.5	≥ 1,700	Cease work and implement dust suppression methods. Continue dust monitoring and if dust suppression methods fail, cease work, begin lead medical monitoring, and upgrade to Level C PPE.	LEVEL C
< 1.5	< 1,700	Continue dust monitoring in Level D PPE.	LEVEL D

NOTES:

¹ Lead concentrations in soil as reported by the USEPA.

mg/m3- milligrams per cubic meter

mg/kg - milligrams per kilogram

PPE - Personal Protective Equipment



Source: NAIP, 2010

Legend

- Fence
- Gate
- Approximate Property Boundary
- Lead Monitoring Area
- Berm
- Gravel Road

Soil Analytical Results for Lead at 6 XRF Locals

- <DCC
- 1,700 ppm
- 12,000 ppm
- 70,000 ppm

DCC – State of Michigan Residential Direct Contact Criteria of 400 ppm (March 2011)
ppm – parts per million



Prepared By: BSM Approved By:
Checked By: DRS Date: 8/18/2011

**Figure K-1
Lead Medical Monitoring Plan**

Former C & H POWER PLANT SITE
LAKE LINDEN,
HOUGHTON COUNTY, MICHIGAN
Project 3293-11-1440

APPENDIX L
ASBESTOS MONITORING
AND SAMPLING PLAN

REQUIREMENTS OF THE ASBESTOS IN CONSTRUCTION STANDARD

3.1.4.2 Personal Monitoring. Personal monitoring will be undertaken to characterize the personal exposure of high-risk employees to the hazardous substances they may encounter on-site. Personal monitoring will be conducted on a representative basis and personnel who are represented by the sampling will be noted in field logs.

The following personal monitoring equipment will be used at the site. Refer to Appendix ____ of this HASP for information on the maintenance and calibration of the equipment.

- (1) Gillian pump, with 25 mm 0.8 µm pore sized mixed cellulose ester cassette with an open-face 50 mm electronically conductive extension cowl.

Personal Monitoring:

Personal monitoring will be undertaken to characterize the worker exposure to asbestos through the monitoring of representative employees. Employee selection will be based on work task and duration of exposure. Sampling will be representative of a full shift and will include at least one sample for each task in each area. Sampling and analysis will be done in accordance with 29 CFR 1926.1101 Appendix A. Contact Cindy Sundquist, CIH, CSP, Regional HSE Manager, prior to sampling.

1. One worker per task per job classification will be selected. The worker selected will be the one believed to have the greatest exposure for the longest duration (if two workers have equal exposures, personal monitoring can be rotated if sampling is to be conducted on more than one day). The exposures to all other workers will assumed to be the same as the chosen individual, or lower. Record the name, social security number, job classification, and company of all workers for whom the sample represents plus record the date(s), number, duration, and location, of each of the samples taken, including a description of the sampling and analytical method being used; and, the procedure used to determine representative employee exposure where applicable. Record the operation involving exposure to asbestos that is being monitored, the PPE and type of respiratory protection devices worn, if any, and any environmental variables (e.g., rain, mist, snow, wind, temperature) that could affect the measurement of employee exposure.
2. Full shift (at least 8-hours) breathing zone samples will be conducted using personal sampling pumps, calibrated before and after each use (with a cassette placed in sampling train during calibration), and set at 2-liters per minute (LPM). If a filter darkens in appearance or if loose dust is seen on the filter, a second sample shall be started.
3. Excursion limit breathing zone sampling (30 minute sampling) will be conducted when workers are conducting tasks with the highest potential for asbestos exposure during the day. Pumps will be calibrated before and after each use (with a cassette placed in sampling train during calibration) and the pump set a 2 LPM

3. Collect samples, open face (do not use cassette used during calibration). After sampling, seal cassette and ship together along with two field blanks in a rigid container with sufficient packing material to prevent dislodging the collected fibers. Packing material that has a high electrostatic charge on its surface (e.g., expanded polystyrene) cannot be used because such material can cause loss of fibers to the sides of the cassette. Samples should be analyzed using OSHA Method identified in Appendix A to 29 CFR 1926.1101 (asbestos fiber counting by Phase Contrast Microscopy (PCM) at 400X).
4. At least one sample per task per site location will be taken in the initial monitoring phase. If the results show asbestos levels below 0.1 fiber per cubic centimeter (f/cc), no further testing will be required in that area for that task. If levels are found to be above 0.1 f/cc, repeat testing will be required. If conditions or tasks change that may result in new or additional exposures to asbestos, additional samples will be taken.
5. Notify all affected workers (both AMEC and subcontractor personnel), in writing, of the results of the analysis within 5-working days of their receipt. Affected workers include not only the worker wearing the pump and filter, but also the others working in the same general area as well.

OTHER REQUIREMENTS IN REGARDS TO ASBESTOS STANDARD

Engineering controls, whenever feasible, shall be used. Wet methods shall be used to minimize dust.

Respirators:

Half or full face, cartridge respirators with an N, P or R 100 filter shall be used until a negative exposure assessment shows that asbestos levels are below 0.1 f/cc. If organics are present which require upgrade to level C PPE, use cartridge also capable of filtering organics.

All workers who wear a cartridge respirator must have been medically cleared, have received respirator training and been fit-tested within the last year.

Decontamination:

Place a sign near the decontamination station is and/or where equipment is decontaminated that states **CAUTION: CLOTHING CONTAMINATED WITH ASBESTOS. DO NOT REMOVE DUST BY BLOWING OR SHAKING.**

Medical Surveillance:

Workers must have been medically cleared to wear respirators within the past year.

If personal sampling results in asbestos levels above the PEL (0.1 f/cc) or Excursion Limit (1 f/cc), medical monitoring for asbestos may be required. Contact Cindy Sundquist.

Training:

All workers with a potential exposure to asbestos at or above the exposure limit of 0.1 f/cc must receive the following training:

1. Methods of recognizing asbestos.
2. The health effects associated with asbestos exposure.
3. The relationship between smoking and asbestos in producing lung cancer.
4. The nature of operations that could result in exposure to asbestos, the importance of necessary protective controls to minimize exposure including, as applicable, engineering controls, work practices, respirators, housekeeping procedures, hygiene facilities, protective clothing, decontamination procedures, emergency procedures, and waste disposal procedures, and any necessary instruction in the use of these controls and procedures.
5. The purpose, proper use, fitting instructions, and limitations of respirators (if annual respirator training was not conducted during last 8-hour HAZWOPER refresher).
6. The appropriate work practices for performing the asbestos job.
7. Medical surveillance program requirements.
8. The content of the Asbestos in Construction standard including appendices.
9. The names, addresses and phone numbers of public health organizations which provide information, materials and/or conduct programs concerning smoking cessation. (Can be met by providing a copy of 29 CFR 1926.1101 Appendix J).
10. The requirements for posting signs and affixing labels and the meaning of the required legends for such signs and labels.

Training shall be provided prior to or at the time of initial assignment and at least annually thereafter.

Signs:

The following sign must be posted at the entrance to the exclusion zone where a potential exposure to asbestos over the PEL has not been ruled out through personal sampling:

**DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTION CLOTHING ARE REQUIRED IN THIS AREA**

Labels:

Labels shall be affixed to all products containing asbestos and to all containers containing such products, including waste containers when asbestos is present in concentrations of 1.0 percent or greater and shall contain the following information

**DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD**

Labels shall also contain a warning statement against breathing asbestos fibers.

Recordkeeping:

AMEC is required to maintain records of all monitoring conducted in regards to asbestos, therefore, a copy of the results of the monitoring must be placed in the employee file and also a copy sent to Cindy Sundquist. In addition to the results, the following information must also be provided:

1. Dates, number, duration, location and results of each of the samples taken. Included with this must be a description of the sampling procedures used to determine representative employee exposure where applicable.
2. A description of the sampling and analytical methods used and evidence of their accuracy.
3. The type of respiratory protective devices and PPE worn.
4. The Name, social security number, company, and job classification of the employees monitored and all other employees (or subcontractors) for whom the sample represents.
5. The environmental variables that could affect the measurement of employee exposure (e.g., cold weather, ground frozen, no wind; vs. warm day, soil dry, windy)

NOTE: These records will be maintained for duration of employment plus 30 years. Medical surveillance records will also be maintained for the same duration.

All records will be made available to associates, upon request.

- **Part Number:** 1926
 - **Part Title:** Safety and Health Regulations for Construction
 - **Subpart:** Z
 - **Subpart Title:** Toxic and Hazardous Substances
 - **Standard Number:** 1926.1101 App A
 - **Title:** OSHA Reference Method - Mandatory
-

This mandatory appendix specifies the procedure for analyzing air samples for asbestos and specifies quality control procedures that must be implemented by laboratories performing the analysis. The sampling and analytical methods described below represent the elements of the available monitoring methods (such as Appendix B of this regulation, the most current version of the OSHA method ID-160, or the most current version of the NIOSH Method 7400). All employers who are required to conduct air monitoring under paragraph (f) of the standard are required to utilize analytical laboratories that use this procedure, or an equivalent method, for collecting and analyzing samples.

Sampling and Analytical Procedure

1. The sampling medium for air samples shall be mixed cellulose ester filter membranes. These shall be designated by the manufacturer as suitable for asbestos counting. See below for rejection of blanks.
2. The preferred collection device shall be the 25-mm diameter cassette with an open-faced 50-mm electrically conductive extension cowl. The 37-mm cassette may be used if necessary but only if written justification for the need to use the 37-mm filter cassette accompanies the sample results in the employee's exposure monitoring record. Do not reuse or reload cassettes for asbestos sample collection.
3. An air flow rate between 0.5 liter/min and 2.5 liters/min shall be selected for the 25/mm cassette. If the 37-mm cassette is used, an air flow rate between 1 liter/min and 2.5 liters/min shall be selected.
4. Where possible, a sufficient air volume for each air sample shall be collected to yield between 100 and 1,300 fibers per square millimeter on the membrane filter. If a filter darkens in appearance or if loose dust is seen on the filter, a second sample shall be started.
5. Ship the samples in a rigid container with sufficient packing material to prevent dislodging the collected fibers. Packing material that has a high electrostatic charge on its surface (e.g., expanded polystyrene) cannot be used because such material can cause loss of fibers to the sides of the cassette.
6. Calibrate each personal sampling pump before and after use with a representative filter cassette installed between the pump and the calibration devices.
7. Personal samples shall be taken in the "breathing zone" of the employee (i.e., attached to or near the collar or lapel near the worker's face).
8. Fiber counts shall be made by positive phase contrast using a microscope with an 8 to 10 X eyepiece and a 40 to 45 X objective for a total magnification of approximately 400 X and a numerical aperture of 0.65 to 0.75. The microscope shall also be fitted with a green or blue filter.
9. The microscope shall be fitted with a Walton-Beckett eyepiece graticule calibrated for a field diameter of 100 micrometers (+/- 2 micrometers).
10. The phase-shift detection limit of the microscope shall be about 3 degrees measured using the HSE phase shift test slide as outlined below.
 - a. Place the test slide on the microscope stage and center it under the phase objective.

b. Bring the blocks of grooved lines into focus.

Note: The slide consists of seven sets of grooved lines (ca. 20 grooves to each block) in descending order of visibility from sets 1 to 7, seven being the least visible. The requirements for asbestos counting are that the microscope optics must resolve the grooved lines in set 3 completely, although they may appear somewhat faint, and that the grooved lines in sets 6 and 7 must be invisible. Sets 4 and 5 must be at least partially visible but may vary slightly in visibility between microscopes. A microscope that fails to meet these requirements has either too low or too high a resolution to be used for asbestos counting.

c. If the image deteriorates, clean and adjust the microscope optics. If the problem persists, consult the microscope manufacturer.

11. Each set of samples taken will include 10% field blanks or a minimum of 2 field blanks. These blanks must come from the same lot as the filters used for sample collection. The field blank results shall be averaged and subtracted from the analytical results before reporting. A set consists of any sample or group of samples for which an evaluation for this standard must be made. Any samples represented by a field blank having a fiber count in excess of the detection limit of the method being used shall be rejected.

12. The samples shall be mounted by the acetone/triacetin method or a method with an equivalent index of refraction and similar clarity.

13. Observe the following counting rules.

a. Count only fibers equal to or longer than 5 micrometers. Measure the length of curved fibers along the curve.

b. In the absence of other information, count all particles as asbestos that have a length-to-width ratio (aspect ratio) of 3:1 or greater.

c. Fibers lying entirely within the boundary of the Walton-Beckett graticule field shall receive a count of 1. Fibers crossing the boundary once, having one end within the circle, shall receive the count of one half (1/2). Do not count any fiber that crosses the graticule boundary more than once. Reject and do not count any other fibers even though they may be visible outside the graticule area.

d. Count bundles of fibers as one fiber unless individual fibers can be identified by observing both ends of an individual fiber.

e. Count enough graticule fields to yield 100 fibers. Count a minimum of 20 fields; stop counting at 100 fields regardless of fiber count.

14. Blind recounts shall be conducted at the rate of 10 percent.

Quality Control Procedures

1. Intralaboratory program. Each laboratory and/or each company with more than one microscopist counting slides shall establish a statistically designed quality assurance program involving blind recounts and comparisons between microscopists to monitor the variability of counting by each microscopist and between microscopists. In a company with more than one laboratory, the program shall include all laboratories, and shall also evaluate the

laboratory-to-laboratory variability.

2.a. Interlaboratory program. Each laboratory analyzing asbestos samples for compliance determination shall implement an interlaboratory quality assurance program that, as a minimum, includes participation of at least two other independent laboratories. Each laboratory shall participate in round robin testing at least once every 6 months with at least all the other laboratories in its interlaboratory quality assurance group. Each laboratory shall submit slides typical of its own workload for use in this program. The round robin shall be designed and results analyzed using appropriate statistical methodology.

2.b. All laboratories should also participate in a national sample testing scheme such as the Proficiency Analytical Testing Program (PAT), or the Asbestos Registry sponsored by the American Industrial Hygiene Association (AIHA).

3. All individuals performing asbestos analysis must have taken the NIOSH course for sampling and evaluating airborne asbestos dust or an equivalent course.

4. When the use of different microscopes contributes to differences between counters and laboratories, the effect of the different microscope shall be evaluated and the microscope shall be replaced, as necessary.

5. Current results of these quality assurance programs shall be posted in each laboratory to keep the microscopists informed.

- **Part Number:** 1926
 - **Part Title:** Safety and Health Regulations for Construction
 - **Subpart:** Z
 - **Subpart Title:** Toxic and Hazardous Substances
 - **Standard Number:** 1926.1101 App B
 - **Title:** Sampling and Analysis - Non-mandatory
-

Matrix

Matrix:

OSHA Permissible Exposure Limits:

Time Weighted Average..... 0.1 fiber/cc
 Excursion Level (30 minutes)..... 1.0 fiber/cc

Collection Procedure:

A known volume of air is drawn through a 25-mm diameter cassette containing a mixed-cellulose ester filter. The cassette must be equipped with an electrically conductive 50-mm extension cowl. The sampling time and rate are chosen to give a fiber density of between 100 to 1,300 fibers/mm² on the filter.

Recommended Sampling Rate..... 0.5 to 5.0 liters/
 minute (L/min)

Recommended Air Volumes:

Minimum..... 25 L
 Maximum..... 2,400 L

Analytical Procedure:

A portion of the sample filter is cleared and prepared for asbestos fiber counting by Phase Contrast Microscopy (PCM) at 400X.

Commercial manufacturers and products mentioned in this method are for descriptive use only and do not constitute endorsements by USDOL-OSHA. Similar products from other sources can be substituted.

1. Introduction

This method describes the collection of airborne asbestos fibers using calibrated sampling pumps with mixed-cellulose ester (MCE) filters and analysis by phase contrast microscopy (PCM). Some terms used are unique to this method and are defined below: Asbestos: A term for naturally occurring fibrous minerals. Asbestos includes chrysotile, crocidolite, amosite (cummingtonite-grunerite asbestos), tremolite asbestos, actinolite asbestos, anthophyllite asbestos, and any of these minerals that have been chemically treated and/or altered. The precise chemical formulation of each species will vary with the location from which it was mined. Nominal compositions are listed:

Chrysotile..... Mg(3)Si(2)O(5)(OH)(4)
 Crocidolite..... Na(2)Fe(3)(2)+Fe(2)(3)+Si(8)O(22)(OH)(2)

Amosite..... (Mg,Fe)(7)Si(8)O(22)(OH)(2)
Tremolite-actinolite..... Ca(2)(Mg,Fe)(5)Si(8)O(22)(OH)(2)
Anthophyllite..... (Mg,Fe)(7)Si(8)O(22)(OH)(2)

Asbestos Fiber: A fiber of asbestos which meets the criteria specified below for a fiber.

Aspect Ratio: The ratio of the length of a fiber to it's diameter (e.g. 3:1, 5:1 aspect ratios).

Cleavage Fragments: Mineral particles formed by comminution of minerals, especially those characterized by parallel sides and a moderate aspect ratio (usually less than 20:1).

Detection Limit: The number of fibers necessary to be 95% certain that the result is greater than zero.

Differential Counting: The term applied to the practice of excluding certain kinds of fibers from the fiber count because they do not appear to be asbestos.

Fiber: A particle that is 5 um or longer, with a length-to-width ratio of 3 to 1 or longer.

Field: The area within the graticule circle that is superimposed on the microscope image.

Set: The samples which are taken, submitted to the laboratory, analyzed, and for which, interim or final result reports are generated.

Tremolite, Anthophyllite, and Actinolite: The non-asbestos form of these minerals which meet the definition of a fiber. It includes any of these minerals that have been chemically treated and/or altered.

Walton-Beckett Graticule: An eyepiece graticule specifically designed for asbestos fiber counting. It consists of a circle with a projected diameter of 100 plus or minus 2 um (area of about 0.00785 mm²) with a crosshair having tic-marks at 3-um intervals in one direction and 5-um in the orthogonal direction. There are marks around the periphery of the circle to demonstrate the proper sizes and shapes of fibers. This design is reproduced in Figure 1. The disk is placed in one of the microscope eyepieces so that the design is superimposed on the field of view.

1.1. History

Early surveys to determine asbestos exposures were conducted using impinger counts of total dust with the counts expressed as million particles per cubic foot. The British Asbestos Research Council recommended filter membrane counting in 1969. In July 1969, the Bureau of Occupational Safety and Health published a filter membrane method for counting asbestos fibers in the United States. This method was refined by NIOSH and published as P & CAM 239. On May 29, 1971, OSHA specified filter membrane sampling with phase contrast counting for evaluation of asbestos exposures at work sites in the United States. The use of this technique was again required by OSHA in 1986. Phase contrast microscopy has continued to be the method of choice for the measurement of occupational exposure to asbestos.

1.2. Principle

Air is drawn through a MCE filter to capture airborne asbestos fibers. A wedge shaped portion of the filter is removed, placed on a glass microscope slide and made transparent. A measured area (field) is viewed by PCM. All the fibers meeting defined criteria for asbestos are counted and considered a measure of the airborne asbestos concentration.

1.3. Advantages and Disadvantages

There are four main advantages of PCM over other methods:

- (1) The technique is specific for fibers. Phase contrast is a fiber counting technique which excludes non-fibrous particles from the analysis.
- (2) The technique is inexpensive and does not require specialized knowledge to carry out the analysis for total fiber counts.
- (3) The analysis is quick and can be performed on-site for rapid determination of air concentrations of asbestos fibers.
- (4) The technique has continuity with historical epidemiological studies so that estimates of expected disease can be inferred from long-term determinations of asbestos exposures.

The main disadvantage of PCM is that it does not positively identify asbestos fibers. Other fibers which are not asbestos may be included in the count unless differential counting is performed. This requires a great deal of experience to adequately differentiate asbestos from non-asbestos fibers. Positive identification of asbestos must be performed by polarized light or electron microscopy techniques. A further disadvantage of PCM is that the smallest visible fibers are about 0.2 μm in diameter while the finest asbestos fibers may be as small as 0.02 μm in diameter. For some exposures, substantially more fibers may be present than are actually counted.

1.4. Workplace Exposure

Asbestos is used by the construction industry in such products as shingles, floor tiles, asbestos cement, roofing felts, insulation and acoustical products. Non-construction uses include brakes, clutch facings, paper, paints, plastics, and fabrics. One of the most significant exposures in the workplace is the removal and encapsulation of asbestos in schools, public buildings, and homes. Many workers have the potential to be exposed to asbestos during these operations.

About 95% of the asbestos in commercial use in the United States is chrysotile. Crocidolite and amosite make up most of the remainder. Anthophyllite and tremolite or actinolite are likely to be encountered as contaminants in various industrial products.

1.5. Physical Properties

Asbestos fiber possesses a high tensile strength along its axis, is chemically inert, non-combustible, and heat resistant. It has a high electrical resistance and good sound absorbing properties. It can be weaved into cables, fabrics or other textiles, and also matted into asbestos papers, felts, or mats.

2. Range and Detection Limit

2.1. The ideal counting range on the filter is 100 to 1,300 fibers/mm². With a Walton-Beckett graticule this range is equivalent to 0.8 to 10 fibers/field. Using NIOSH counting statistics, a count of 0.8 fibers/field would give an approximate coefficient of variation (CV) of 0.13.

2.2. The detection limit for this method is 4.0 fibers per 100 fields or 5.5 fibers/mm². This was determined using an equation to estimate the maximum CV possible at a specific concentration (95% confidence) and a Lower Control Limit of zero. The CV value was then used to determine a corresponding concentration from historical CV vs fiber relationships. As an example:

$$\text{Lower Control Limit (95\% Confidence)} = AC - 1.645(CV)(AC)$$

Where:

AC = Estimate of the airborne fiber concentration (fibers/cc) Setting the Lower Control Limit = 0 and solving for CV:

$0 = AC - 1.645(CV)(AC)$

CV = 0.61

This value was compared with CV vs. count curves. The count at which CV = 0.61 for Leidel-Busch counting statistics or for an OSHA Salt Lake Technical Center (OSHA-SLTC) CV curve (see Appendix A for further information) was 4.4 fibers or 3.9 fibers per 100 fields, respectively. Although a lower detection limit of 4 fibers per 100 fields is supported by the OSHA-SLTC data, both data sets support the 4.5 fibers per 100 fields value.

3. Method Performance -- Precision and Accuracy

Precision is dependent upon the total number of fibers counted and the uniformity of the fiber distribution on the filter. A general rule is to count at least 20 and not more than 100 fields. The count is discontinued when 100 fibers are counted, provided that 20 fields have already been counted. Counting more than 100 fibers results in only a small gain in precision. As the total count drops below 10 fibers, an accelerated loss of precision is noted.

At this time, there is no known method to determine the absolute accuracy of the asbestos analysis. Results of samples prepared through the Proficiency Analytical Testing (PAT) Program and analyzed by the OSHA-SLTC showed no significant bias when compared to PAT reference values. The PAT samples were analyzed from 1987 to 1989 (N = 36) and the concentration range was from 120 to 1,300 fibers/mm(2).

4. Interferences

Fibrous substances, if present, may interfere with asbestos analysis.

Some common fibers are:

- Fiberglass
- Anhydrite
- Plant Fibers
- Perlite Veins
- Gypsum
- Some Synthetic Fibers
- Membrane Structures
- Sponge Spicules
- Diatoms
- Microorganisms
- Wollastonite

The use of electron microscopy or optical tests such as polarized light, and dispersion staining may be used to differentiate these materials from asbestos when necessary.

5. Sampling

5.1. Equipment

5.1.1. Sample assembly (The assembly is shown in Figure 3). Conductive filter holder consisting of a 25-mm diameter, 3-piece cassette having a 50-mm long electrically conductive extension cowl. Backup pad, 25-mm,

cellulose. Membrane filter, mixed-cellulose ester (MCE), 25-mm, plain, white, 0.4 to 1.2-um pore size.

Notes:

(a) DO NOT RE-USE CASSETTES.

(b) Fully conductive cassettes are required to reduce fiber loss to the sides of the cassette due to electrostatic attraction.

(c) Purchase filters which have been selected by the manufacturer for asbestos counting or analyze representative filters for fiber background before use. Discard the filter lot if more than 4 fibers/ 100 fields are found.

(d) To decrease the possibility of contamination, the sampling system (filter-backup pad-cassette) for asbestos is usually preassembled by the manufacturer.

(e) Other cassettes, such as the Bell-mouth, may be used within the limits of their validation.

5.1.2. Gel bands for sealing cassettes.

5.1.3. Sampling pump.

Each pump must be a battery operated, self-contained unit small enough to be placed on the monitored employee and not interfere with the work being performed. The pump must be capable of sampling at the collection rate for the required sampling time.

5.1.4. Flexible tubing, 6-mm bore.

5.1.5. Pump calibration.

Stopwatch and bubble tube/burette or electronic meter.

5.2. Sampling Procedure

5.2.1. Seal the point where the base and cowl of each cassette meet with a gel band or tape.

5.2.2. Charge the pumps completely before beginning.

5.2.3. Connect each pump to a calibration cassette with an appropriate length of 6-mm bore plastic tubing. Do not use luer connectors -- the type of cassette specified above has built-in adapters.

5.2.4. Select an appropriate flow rate for the situation being monitored. The sampling flow rate must be between 0.5 and 5.0 L/min for personal sampling and is commonly set between 1 and 2 L/min. Always choose a flow rate that will not produce overloaded filters.

5.2.5. Calibrate each sampling pump before and after sampling with a calibration cassette in-line (Note: This calibration cassette should be from the same lot of cassettes used for sampling). Use a primary standard (e.g. bubble burette) to calibrate each pump. If possible, calibrate at the sampling site.

Note: If sampling site calibration is not possible, environmental influences may affect the flow rate. The extent is dependent on the type of pump used. Consult with the pump manufacturer to determine dependence on environmental influences. If the pump is affected by temperature and pressure changes, correct the flow rate

using the formula shown in the section "Sampling Pump Flow Rate Corrections" at the end of this appendix.

5.2.6. Connect each pump to the base of each sampling cassette with flexible tubing. Remove the end cap of each cassette and take each air sample open face. Assure that each sample cassette is held open side down in the employee's breathing zone during sampling. The distance from the nose/mouth of the employee to the cassette should be about 10 cm. Secure the cassette on the collar or lapel of the employee using spring clips or other similar devices.

5.2.7. A suggested minimum air volume when sampling to determine TWA compliance is 25 L. For Excursion Limit (30 min sampling time) evaluations, a minimum air volume of 48 L is recommended.

5.2.8. The most significant problem when sampling for asbestos is overloading the filter with non-asbestos dust. Suggested maximum air sample volumes for specific environments are:

Environment	Air Vol. (L)
Asbestos removal operations (visible dust).....	100.
Asbestos removal operations (little dust).....	240.
Office environments.....	400 to 2,400.

CAUTION: Do not overload the filter with dust. High levels of non-fibrous dust particles may obscure fibers on the filter and lower the count or make counting impossible. If more than about 25 to 30% of the field area is obscured with dust, the result may be biased low. Smaller air volumes may be necessary when there is excessive non-asbestos dust in the air.

While sampling, observe the filter with a small flashlight. If there is a visible layer of dust on the filter, stop sampling, remove and seal the cassette, and replace with a new sampling assembly. The total dust loading should not exceed 1 mg.

5.2.9. Blank samples are used to determine if any contamination has occurred during sample handling. Prepare two blanks for the first 1 to 20 samples. For sets containing greater than 20 samples, prepare blanks as 10% of the samples. Handle blank samples in the same manner as air samples with one exception: Do not draw any air through the blank samples. Open the blank cassette in the place where the sample cassettes are mounted on the employee. Hold it open for about 30 seconds. Close and seal the cassette appropriately. Store blanks for shipment with the sample cassettes.

5.2.10. Immediately after sampling, close and seal each cassette with the base and plastic plugs. Do not touch or puncture the filter membrane as this will invalidate the analysis.

5.2.11. Attach and secure a sample seal around each sample cassette in such a way as to assure that the end cap and base plugs cannot be removed without destroying the seal. Tape the ends of the seal together since the seal is not long enough to be wrapped end-to-end. Also wrap tape around the cassette at each joint to keep the seal secure.

5.3. Sample Shipment

5.3.1. Send the samples to the laboratory with paperwork requesting asbestos analysis. List any known fibrous

interferences present during sampling on the paperwork. Also, note the workplace operation(s) sampled.

5.3.2. Secure and handle the samples in such that they will not rattle during shipment nor be exposed to static electricity. Do not ship samples in expanded polystyrene peanuts, vermiculite, paper shreds, or excelsior. Tape sample cassettes to sheet bubbles and place in a container that will cushion the samples in such a manner that they will not rattle.

5.3.3. To avoid the possibility of sample contamination, always ship bulk samples in separate mailing containers.

6. Analysis

6.1. Safety Precautions

6.1.1. Acetone is extremely flammable and precautions must be taken not to ignite it. Avoid using large containers or quantities of acetone. Transfer the solvent in a ventilated laboratory hood. Do not use acetone near any open flame. For generation of acetone vapor, use a spark free heat source.

6.1.2. Any asbestos spills should be cleaned up immediately to prevent dispersal of fibers. Prudence should be exercised to avoid contamination of laboratory facilities or exposure of personnel to asbestos. Asbestos spills should be cleaned up with wet methods and/ or a High Efficiency Particulate-Air (HEPA) filtered vacuum.

CAUTION: Do not use a vacuum without a HEPA filter -- It will disperse fine asbestos fibers in the air.

6.2. Equipment

6.2.1. Phase contrast microscope with binocular or trinocular head.

6.2.2. Widefield or Huygenian 10X eyepieces (NOTE: The eyepiece containing the graticule must be a focusing eyepiece. Use a 40X phase objective with a numerical aperture of 0.65 to 0.75).

6.2.3. Kohler illumination (if possible) with green or blue filter.

6.2.4. Walton-Beckett Graticule, type G-22 with 100 plus or minus 2 um projected diameter.

6.2.5. Mechanical stage. A rotating mechanical stage is convenient for use with polarized light.

6.2.6. Phase telescope.

6.2.7. Stage micrometer with 0.01-mm subdivisions.

6.2.8. Phase-shift test slide, mark II (Available from PTR optics Ltd., and also McCrone).

6.2.9. Precleaned glass slides, 25 mm X 75 mm. One end can be frosted for convenience in writing sample numbers, etc., or paste-on labels can be used.

6.2.10. Cover glass #1 1/2.

6.2.11. Scalpel (#10, curved blade).

6.2.12. Fine tipped forceps.

6.2.13. Aluminum block for clearing filter (see Appendix D and Figure 4).

6.2.14. Automatic adjustable pipette, 100- to 500-uL.

6.2.15. Micropipette, 5 uL.

6.3. Reagents

6.3.1. Acetone (HPLC grade).

6.3.2. Triacetin (glycerol triacetate).

6.3.3. Lacquer or nail polish.

6.4. Standard Preparation

A way to prepare standard asbestos samples of known concentration has not been developed. It is possible to prepare replicate samples of nearly equal concentration. This has been performed through the PAT program. These asbestos samples are distributed by the AIHA to participating laboratories.

Since only about one-fourth of a 25-mm sample membrane is required for an asbestos count, any PAT sample can serve as a "standard" for replicate counting.

6.5. Sample Mounting

Note: See Safety Precautions in Section 6.1. before proceeding. The objective is to produce samples with a smooth (non-grainy) background in a medium with a refractive index of approximately 1.46. The technique below collapses the filter for easier focusing and produces permanent mounts which are useful for quality control and interlaboratory comparison.

An aluminum block or similar device is required for sample preparation.

6.5.1. Heat the aluminum block to about 70 deg.C. The hot block should not be used on any surface that can be damaged by either the heat or from exposure to acetone.

6.5.2. Ensure that the glass slides and cover glasses are free of dust and fibers.

6.5.3. Remove the top plug to prevent a vacuum when the cassette is opened. Clean the outside of the cassette if necessary. Cut the seal and/or tape on the cassette with a razor blade. Very carefully separate the base from the extension cowl, leaving the filter and backup pad in the base.

6.5.4. With a rocking motion cut a triangular wedge from the filter using the scalpel. This wedge should be one-sixth to one-fourth of the filter. Grasp the filter wedge with the forceps on the perimeter of the filter which was clamped between the cassette pieces. DO NOT TOUCH the filter with your finger. Place the filter on the glass slide sample side up. Static electricity will usually keep the filter on the slide until it is cleared.

6.5.5. Place the tip of the micropipette containing about 200 uL acetone into the aluminum block. Insert the glass slide into the receiving slot in the aluminum block. Inject the acetone into the block with slow, steady pressure on the plunger while holding the pipette firmly in place. Wait 3 to 5 seconds for the filter to clear, then remove the pipette and slide from the aluminum block.

6.5.6. Immediately (less than 30 seconds) place 2.5 to 3.5 uL of triacetin on the filter (NOTE: Waiting longer than

30 seconds will result in increased index of refraction and decreased contrast between the fibers and the preparation. This may also lead to separation of the cover slip from the slide).

6.5.7. Lower a cover slip gently onto the filter at a slight angle to reduce the possibility of forming air bubbles. If more than 30 seconds have elapsed between acetone exposure and triacetin application, glue the edges of the cover slip to the slide with lacquer or nail polish.

6.5.8. If clearing is slow, warm the slide for 15 min on a hot plate having a surface temperature of about 50 deg.C to hasten clearing. The top of the hot block can be used if the slide is not heated too long.

6.5.9. Counting may proceed immediately after clearing and mounting are completed.

6.6. Sample Analysis

Completely align the microscope according to the manufacturer's instructions. Then, align the microscope using the following general alignment routine at the beginning of every counting session and more often if necessary.

6.6.1. Alignment

(1) Clean all optical surfaces. Even a small amount of dirt can significantly degrade the image.

(2) Rough focus the objective on a sample.

(3) Close down the field iris so that it is visible in the field of view. Focus the image of the iris with the condenser focus. Center the image of the iris in the field of view.

(4) Install the phase telescope and focus on the phase rings. Critically center the rings. Misalignment of the rings results in astigmatism which will degrade the image.

(5) Place the phase-shift test slide on the microscope stage and focus on the lines. The analyst must see line set 3 and should see at least parts of 4 and 5 but, not see line set 6 or 6. A microscope/microscopist combination which does not pass this test may not be used.

6.6.2. Counting Fibers

(1) Place the prepared sample slide on the mechanical stage of the microscope. Position the center of the wedge under the objective lens and focus upon the sample.

(2) Start counting from one end of the wedge and progress along a radial line to the other end (count in either direction from perimeter to wedge tip). Select fields randomly, without looking into the eyepieces, by slightly advancing the slide in one direction with the mechanical stage control.

(3) Continually scan over a range of focal planes (generally the upper 10 to 15 um of the filter surface) with the fine focus control during each field count. Spend at least 5 to 15 seconds per field.

(4) Most samples will contain asbestos fibers with fiber diameters less than 1 um. Look carefully for faint fiber images. The small diameter fibers will be very hard to see. However, they are an important contribution to the total count.

(5) Count only fibers equal to or longer than 5 um. Measure the length of curved fibers along the curve.

(6) Count fibers which have a length to width ratio of 3:1 or greater.

(7) Count all the fibers in at least 20 fields. Continue counting until either 100 fibers are counted or 100 fields have been viewed; whichever occurs first. Count all the fibers in the final field.

(8) Fibers lying entirely within the boundary of the Walton-Beckett graticule field shall receive a count of 1. Fibers crossing the boundary once, having one end within the circle shall receive a count of 1/2. Do not count any fiber that crosses the graticule boundary more than once. Reject and do not count any other fibers even though they may be visible outside the graticule area. If a fiber touches the circle, it is considered to cross the line.

(9) Count bundles of fibers as one fiber unless individual fibers can be clearly identified and each individual fiber is clearly not connected to another counted fiber. See Figure 1 for counting conventions.

(10) Record the number of fibers in each field in a consistent way such that filter non-uniformity can be assessed.

(11) Regularly check phase ring alignment.

(12) When an agglomerate (mass of material) covers more than 25% of the field of view, reject the field and select another. Do not include it in the number of fields counted.

(13) Perform a "blind recount" of 1 in every 10 filter wedges (slides). Re-label the slides using a person other than the original counter.

6.7. Fiber Identification

As previously mentioned in Section 1.3., PCM does not provide positive confirmation of asbestos fibers. Alternate differential counting techniques should be used if discrimination is desirable. Differential counting may include primary discrimination based on morphology, polarized light analysis of fibers, or modification of PCM data by Scanning Electron or Transmission Electron Microscopy.

A great deal of experience is required to routinely and correctly perform differential counting. It is discouraged unless it is legally necessary. Then, only if a fiber is obviously not asbestos should it be excluded from the count. Further discussion of this technique can be found in reference 8.10.

If there is a question whether a fiber is asbestos or not, follow the rule:

"WHEN IN DOUBT, COUNT."

6.8. Analytical Recommendations -- Quality Control System

6.8.1. All individuals performing asbestos analysis must have taken the NIOSH course for sampling and evaluating airborne asbestos or an equivalent course.

6.8.2. Each laboratory engaged in asbestos counting shall set up a slide trading arrangement with at least two other laboratories in order to compare performance and eliminate inbreeding of error. The slide exchange occurs at least semiannually. The round robin results shall be posted where all analysts can view individual analyst's results.

6.8.3. Each laboratory engaged in asbestos counting shall participate in the Proficiency Analytical Testing Program, the Asbestos Analyst Registry or equivalent.

6.8.4. Each analyst shall select and count prepared slides from a "slide bank". These are quality assurance counts.

The slide bank shall be prepared using uniformly distributed samples taken from the workload. Fiber densities should cover the entire range routinely analyzed by the laboratory. These slides are counted blind by all counters to establish an original standard deviation. This historical distribution is compared with the quality assurance counts. A counter must have 95% of all quality control samples counted within three standard deviations of the historical mean. This count is then integrated into a new historical mean and standard deviation for the slide.

The analyses done by the counters to establish the slide bank may be used for an interim quality control program if the data are treated in a proper statistical fashion.

7. Calculations

7.1. Calculate the estimated airborne asbestos fiber concentration on the filter sample using the following formula:

(For Equation A, [Click Here](#))

where:

AC = Airborne fiber concentration
FB = Total number of fibers greater than 5 um counted
FL = Total number of fields counted on the filter
BFB = Total number of fibers greater than 5 um counted in the blank
BFL = Total number of fields counted on the blank
ECA = Effective collecting area of filter (385 mm² nominal for a 25-mm filter.)
FR = Pump flow rate (L/min)
MFA = Microscope count field area (mm²). This is 0.00785 mm² for a Walton-Beckett Graticule.
T = Sample collection time (min)
1,000 = Conversion of L to cc

Note: The collection area of a filter is seldom equal to 385 mm². It is appropriate for laboratories to routinely monitor the exact diameter using an inside micrometer. The collection area is calculated according to the formula:

$$\text{Area} = \pi(d/2)^2$$

7.2. Short-Cut Calculation

Since a given analyst always has the same interpupillary distance, the number of fields per filter for a particular analyst will remain constant for a given size filter. The field size for that analyst is constant (i.e. the analyst is using an assigned microscope and is not changing the reticle).

For example, if the exposed area of the filter is always 385 mm² and the size of the field is always 0.00785 mm² the number of fields per filter will always be 49,000. In addition it is necessary to convert liters of air to cc. These three constants can then be combined such that $ECA/(1,000 \times MFA) = 49$. The previous equation simplifies to:

(For Equation B, [Click Here](#))

7.3. Recount Calculations

As mentioned in step 13 of Section 6.6.2., a "blind recount" of 10% of the slides is performed. In all cases, differences will be observed between the first and second counts of the same filter wedge. Most of these differences will be due to chance alone, that is, due to the random variability (precision) of the count method. Statistical recount criteria enables one to decide whether observed differences can be explained due to chance alone or are probably due to systematic differences between analysts, microscopes, or other biasing factors.

The following recount criterion is for a pair of counts that estimate AC in fibers/cc. The criterion is given at the type-I error level. That is, there is 5% maximum risk that we will reject a pair of counts for the reason that one might be biased, when the large observed difference is really due to chance.

Reject a pair of counts if:

(For Equation C, [Click Here](#))

Where:

AC(1) = lower estimated airborne fiber concentration

AC(2) = higher estimated airborne fiber concentration

AC(avg) = average of the two concentration estimates

CV(FB) = CV for the average of the two concentration estimates

If a pair of counts are rejected by this criterion then, recount the rest of the filters in the submitted set. Apply the test and reject any other pairs failing the test. Rejection shall include a memo to the industrial hygienist stating that the sample failed a statistical test for homogeneity and the true air concentration may be significantly different than the reported value.

7.4. Reporting Results

Report results to the industrial hygienist as fibers/cc. Use two significant figures. If multiple analyses are performed on a sample, an average of the results is to be reported unless any of the results can be rejected for cause.

8. References

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8.2. Asbestos Research Council: The Measurement of Airborne Asbestos Dust by the Membrane Filter Method (Technical Note), Asbestos Research Council, Rockdale, Lancashire, Great Britain, 1969.

8.3. Bayer, S.G., Zumwalde, R.D., Brown, T.A., Equipment and Procedure for Mounting Millipore Filters and Counting Asbestos Fibers by Phase Contrast Microscopy, Bureau of Occupational Health, U.S. Dept. of Health, Education and Welfare, Cincinnati, OH, 1969.

8.4. NIOSH Manual of Analytical Methods, 2nd ed., Vol. 1 (DHEW/ NIOSH Pub. No. 77-157-A). National Institute for Occupational Safety and Health, Cincinnati, OH, 1977. pp. 239-1 -- 239-21.

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8.6. Occupational Exposure to Asbestos, Tremolite, Anthophyllite, and Actinolite. Final Rule, Federal Register 51:119 (20 June 1986). pp. 22612-22790.

8.7. Asbestos, Tremolite, Anthophyllite, and Actinolite, Code of Federal Regulations 1910.1001. 1988. pp. 711-752.

8.8. Criteria for a Recommended Standard -- Occupational Exposure to Asbestos (DHEW/NIOSH Pub. No. HSM 72-10267), National Institute for Occupational Safety and Health, NIOSH, Cincinnati, OH, 1972. pp. III-1 -- III-24.

8.9. Leidel, N.A., Bayer, S.G., Zumwalde, R.D., Busch, K.A., USPHS/NIOSH Membrane Filter Method for Evaluating Airborne Asbestos Fibers (DHEW/NIOSH Pub. No. 79-127). National Institute for Occupational Safety and Health, Cincinnati, OH, 1979.

8.10. Dixon, W.C., Applications of Optical Microscopy in Analysis of Asbestos and Quartz, Analytical Techniques in Occupational Health Chemistry, edited by D.D. Dollberg and A.W. Verstuyft. Wash. D.C.: American Chemical Society, (ACS Symposium Series 120) 1980. pp. 13-41.

Quality Control

The OSHA asbestos regulations require each laboratory to establish a quality control program. The following is presented as an example of how the OSHA-SLTC constructed its internal CV curve as part of meeting this requirement. Data is from 395 samples collected during OSHA compliance inspections and analyzed from October 1980 through April 1986.

Each sample was counted by 2 to 5 different counters independently of one another. The standard deviation and the CV statistic was calculated for each sample. This data was then plotted on a graph of CV vs. fibers/mm(2). A least squares regression was performed using the following equation:

$$CV = \text{antilog}(10)[A(\log(10)(x))^2 + B(\log(10)(x)) + C]$$

where:

x = the number of fibers/mm(2)

Application of least squares gave:

$$A = 0.182205$$

$$B = 0.973343$$

$$C = 0.327499$$

Using these values, the equation becomes:

$$CV = \text{antilog}(10)[0.182205(\log(10)(x))^2 - 0.973343(\log(10)(x)) + 0.327499]$$

Sampling Pump Flow Rate Corrections

This correction is used if a difference greater than 5% in ambient temperature and/or pressure is noted between calibration and sampling sites and the pump does not compensate for the differences.

(For Equation D, [Click Here](#))

Where:

Q(act) = actual flow rate

$Q(\text{cal})$ = calibrated flow rate (if a rotameter was used, the rotameter value)
 $P(\text{cal})$ = uncorrected air pressure at calibration
 $P(\text{act})$ = uncorrected air pressure at sampling site
 $T(\text{act})$ = temperature at sampling site (K)
 $T(\text{cal})$ = temperature at calibration (K)

Walton-Beckett Graticule

When ordering the Graticule for asbestos counting, specify the exact disc diameter needed to fit the ocular of the microscope and the diameter (mm) of the circular counting area. Instructions for measuring the dimensions necessary are listed:

- (1) Insert any available graticule into the focusing eyepiece and focus so that the graticule lines are sharp and clear.
- (2) Align the microscope.
- (3) Place a stage micrometer on the microscope object stage and focus the microscope on the graduated lines.
- (4) Measure the magnified grid length, PL (um), using the stage micrometer.
- (5) Remove the graticule from the microscope and measure its actual grid length, AL (mm). This can be accomplished by using a mechanical stage fitted with verniers, or a jeweler's loupe with a direct reading scale.
- (6) Let $D = 100 \text{ um}$. Calculate the circle diameter, $d(c)(\text{mm})$, for the Walton-Beckett graticule and specify the diameter when making a purchase:

$$d(c) = \frac{AL \times D}{PL}$$

Example:

If $PL = 108 \text{ um}$, $AL = 2.93 \text{ mm}$ and $D = 100 \text{ um}$,
then,

$$d(c) = \frac{2.93 \times 100}{108} = 2.71\text{mm}$$

(7) Each eyepiece-objective-reticle combination on the microscope must be calibrated. Should any of the three be changed (by zoom adjustment, disassembly, replacement, etc.), the combination must be recalibrated. Calibration may change if interpupillary distance is changed.

Measure the field diameter, D (acceptable range: 100 plus or minus 2 um) with a stage micrometer upon receipt of the graticule from the manufacturer. Determine the field area (mm^2).

Field Area = $\pi(D/2)^2$
 If $D = 100 \text{ um} = 0.1 \text{ mm}$, then

$$\text{Field Area} = \pi(0.1 \text{ mm}/2)(2) = 0.00785 \text{ mm}^2$$

The Graticule is available from: Graticules Ltd., Morley Road, Tonbridge TN9 1RN, Kent, England (Telephone 011-44-732-359061). Also available from PTR Optics Ltd., 145 Newton Street, Waltham, MA 02154 [telephone (617) 891-6000] or McCrone Accessories and Components, 2506 S. Michigan Ave., Chicago, IL 60616 [phone (312)-842-7100]. The graticule is custom made for each microscope.

(For Figure 1 of Walton-Beckett Graticule, [Click Here](#))

Counts for the Fibers in the Figure

Structure No.	Count	Explanation
1 to 6.....	1	Single fibers all contained within the Circle.
7.....	1/2	Fiber crosses circle once.
8.....	0	Fiber too short.
9.....	2	Two crossing fibers.
10.....	0	Fiber outside graticule.
11.....	0	Fiber crosses graticule twice.
12.....	1/2	Although split, fiber only crosses once.

• Part Number:	1926
• Part Title:	Safety and Health Regulations for Construction
• Subpart:	Z
• Subpart Title:	Toxic and Hazardous Substances
• Standard Number:	1926.1101 App H
• Title:	Substance Technical Information for Asbestos - Non-Mandatory

I. Substance Identification

A. Substance: "Asbestos" is the name of a class of magnesium-silicate minerals that occur in fibrous form. Minerals that are included in this group are chrysotile, crocidolite, amosite, anthophyllite asbestos, tremolite asbestos, and actinolite asbestos.

B. Asbestos is and was used in the manufacture of heat-resistant clothing, automotive brake and clutch linings, and a variety of building materials including floor tiles, roofing felts, ceiling tiles, asbestos-cement pipe and sheet, and fire-resistant drywall. Asbestos is also present in pipe and boiler insulation materials and in sprayed-on materials located on beams, in crawlspaces, and between walls.

C. The potential for an asbestos-containing product to release breathable fibers depends largely on its degree of friability. Friable means that the material can be crumbled with hand pressure and is therefore likely to emit fibers. The fibrous fluffy sprayed-on materials used for fireproofing, insulation, or sound proofing are considered to be friable, and they readily release airborne fibers if disturbed. Materials such as vinyl-asbestos floor tile or roofing felt are considered non-friable if intact and generally do not emit airborne fibers unless subjected to sanding, sawing and other aggressive operations. Asbestos-cement pipe or sheet can emit airborne fibers if the materials are cut or sawed, or if they are broken.

D. Permissible exposure: Exposure to airborne asbestos fibers may not exceed 0.1 fibers per cubic centimeter of air (0.1 f/cc) averaged over the 8-hour workday, and 1 fiber per cubic centimeter of air (1.0 f/cc) averaged over a 30 minute work period.

II. Health Hazard Data

A. Asbestos can cause disabling respiratory disease and various types of cancers if the fibers are inhaled. Inhaling or ingesting fibers from contaminated clothing or skin can also result in these diseases. The symptoms of these diseases generally do not appear for 20 or more years after initial exposure.

B. Exposure to asbestos has been shown to cause lung cancer, mesothelioma, and cancer of the stomach and colon. Mesothelioma is a rare cancer of the thin membrane lining of the chest and abdomen. Symptoms of mesothelioma include shortness of breath, pain in the walls of the chest, and/or abdominal pain.

III. Respirators and Protective Clothing

A. Respirators: You are required to wear a respirator when performing tasks that result in asbestos exposure that exceeds the permissible exposure limit (PEL) of 0.1 f/cc and when performing certain designated operations. Air-purifying respirators equipped with a high-efficiency particulate air (HEPA) filter can be used where airborne asbestos fiber concentrations do not exceed 1.0 f/cc; otherwise, more protective respirators such as air-supplied, positive-pressure, full facepiece respirators must be used. Disposable respirators or dust masks are not permitted to be used for asbestos work. For effective protection, respirators must fit your face and head snugly. Your employer is required to conduct a fit test when you are first assigned a respirator and every 6 months thereafter. Respirators should not be loosened or removed in work situations where their use is required.

B. Protective Clothing: You are required to wear protective clothing in work areas where asbestos fiber concentrations exceed the permissible exposure limit (PEL) of 0.1 f/cc.

IV. Disposal Procedures and Clean-up

A. Wastes that are generated by processes where asbestos is present include:

1. Empty asbestos shipping containers.
2. Process wastes such as cuttings, trimmings, or reject materials.
3. Housekeeping waste from wet-sweeping or HEPA-vacuuming.
4. Asbestos fireproofing or insulating material that is removed from buildings.
5. Asbestos-containing building products removed during building renovation or demolition.
6. Contaminated disposable protective clothing.

B. Empty shipping bags can be flattened under exhaust hoods and packed into airtight containers for disposal. Empty shipping drums are difficult to clean and should be sealed.

C. Vacuum bags or disposable paper filters should not be cleaned, but should be sprayed with a fine water mist and placed into a labeled waste container.

D. Process waste and housekeeping waste should be wetted with water or a mixture of water and surfactant prior to packaging in disposable containers.

E. Asbestos-containing material that is removed from buildings must be disposed of in leak-tight 6-mil plastic bags, plastic-lined cardboard containers, or plastic-lined metal containers. These wastes, which are removed while wet, should be sealed in containers before they dry out to minimize the release of asbestos fibers during handling.

V. Access to Information

A. Each year, your employer is required to inform you of the information contained in this standard and appendices for asbestos. In addition, your employer must instruct you in the proper work practices for handling asbestos-containing materials, and the correct use of protective equipment.

B. Your employer is required to determine whether you are being exposed to asbestos. Your employer must treat exposure to thermal system insulation and sprayed-on and troweled-on surfacing material as asbestos exposure, unless results of laboratory analysis show that the material does not contain asbestos. You or your representative has the right to observe employee measurements and to record the results obtained. Your employer is required to inform you of your exposure, and, if you are exposed above the permissible exposure limit, he or she is required to inform you of the actions that are being taken to reduce your exposure to within the permissible limit.

C. Your employer is required to keep records of your exposures and medical examinations. These exposure records must be kept for at least thirty (30) years. Medical records must be kept for the period of your employment plus thirty (30) years.

D. Your employer is required to release your exposure and medical records to your physician or designated representative upon your written request.

[59 FR 40964, Aug. 10, 1994; 60 FR 33972, June 29, 1995]

• Part Number:	1926
• Part Title:	Safety and Health Regulations for Construction
• Subpart:	Z
• Subpart Title:	Toxic and Hazardous Substances
• Standard Number:	1926.1101 App I
• Title:	Medical surveillance guidelines for asbestos, non-mandatory

I. Route of Entry

Inhalation, ingestion.

II. Toxicology

Clinical evidence of the adverse effects associated with exposure to asbestos is present in the form of several well-conducted epidemiological studies of occupationally exposed workers, family contacts of workers, and persons living near asbestos mines. These studies have shown a definite association between exposure to asbestos and an increased incidence of lung cancer, pleural and peritoneal mesothelioma, gastrointestinal cancer, and asbestosis. The latter is a disabling fibrotic lung disease that is caused only by exposure to asbestos. Exposure to asbestos has also been associated with an increased incidence of esophageal, kidney, laryngeal, pharyngeal, and buccal cavity cancers. As with other known chronic occupational diseases, disease associated with asbestos generally appears about 20 years following the first occurrence of exposure: There are no known acute effects associated with exposure to asbestos.

Epidemiological studies indicate that the risk of lung cancer among exposed workers who smoke cigarettes is greatly increased over the risk of lung cancer among non-exposed smokers or exposed nonsmokers. These studies suggest that cessation of smoking will reduce the risk of lung cancer for a person exposed to asbestos, but will not reduce it to the same level of risk as that existing for an exposed worker who has never smoked.

III. Signs and Symptoms of Exposure-Related Disease

The signs and symptoms of lung cancer or gastrointestinal cancer induced by exposure to asbestos are not unique, except that a chest X-ray of an exposed patient with lung cancer may show pleural plaques, pleural calcification, or pleural fibrosis. Symptoms characteristic of mesothelioma include shortness of breath, pain in the walls of the chest, or abdominal pain. Mesothelioma has a much longer latency period compared with lung cancer (40 years versus 15-20 years), and mesothelioma is therefore more likely to be found among workers who were first exposed to asbestos at an early age. Mesothelioma is always fatal.

Asbestosis is pulmonary fibrosis caused by the accumulation of asbestos fibers in the lungs. Symptoms include shortness of breath, coughing, fatigue, and vague feelings of sickness. When the fibrosis worsens, shortness of breath occurs even at rest. The diagnosis of asbestosis is based on a history of exposure to asbestos, the presence of characteristics radiologic changes, end-inspiratory crackles (rales), and other clinical features of fibrosing lung disease. Pleural plaques and thickening are observed on X-rays taken during the early stages of the disease. Asbestosis is often a progressive disease even in the absence of continued exposure, although this appears to be a highly individualized characteristic. In severe cases, death may be caused by respiratory or cardiac failure.

IV. Surveillance and Preventive Considerations

As noted above, exposure to asbestos has been linked to an increased risk of lung cancer, mesothelioma, gastrointestinal cancer, and asbestosis among occupationally exposed workers. Adequate screening tests to determine an employee's potential for developing serious chronic diseases, such as a cancer, from exposure to asbestos do not presently exist. However, some tests, particularly chest X-rays and pulmonary function tests, may indicate that an employee has been overexposed to asbestos, increasing his or her risk of developing exposure related chronic diseases. It is important for the physician to become familiar with the operating conditions in

which occupational exposure to asbestos is likely to occur. This is particularly important in evaluating medical and work histories and in conducting physical examinations. When an active employee has been identified as having been overexposed to asbestos measures taken by the employer to eliminate or mitigate further exposure should also lower the risk of serious long-term consequences.

The employer is required to institute a medical surveillance program for all employees who are or will be exposed to asbestos at or above the permissible exposure limit (0.1 fiber per cubic centimeter of air). All examinations and procedures must be performed by or under the supervision of a licensed physician, at a reasonable time and place, and at no cost to the employee.

Although broad latitude is given to the physician in prescribing specific tests to be included in the medical surveillance program, OSHA requires inclusion of the following elements in the routine examination:

- (i) Medical and work histories with special emphasis directed to symptoms of the respiratory system, cardiovascular system, and digestive tract.
- (ii) Completion of the respiratory disease questionnaire contained in Appendix D.
- (iii) A physical examination including a chest roentgenogram and pulmonary function test that includes measurement of the employee's forced vital capacity (FVC) and forced expiratory volume at one second (FEV1).
- (iv) Any laboratory or other test that the examining physician deems by sound medical practice to be necessary.

The employer is required to make the prescribed tests available at least annually to those employees covered; more often than specified if recommended by the examining physician; and upon termination of employment.

The employer is required to provide the physician with the following information: A copy of this standard and appendices; a description of the employee's duties as they relate to asbestos exposure; the employee's representative level of exposure to asbestos; a description of any personal protective and respiratory equipment used; and information from previous medical examinations of the affected employee that is not otherwise available to the physician. Making this information available to the physician will aid in the evaluation of the employee's health in relation to assigned duties and fitness to wear personal protective equipment, if required.

The employer is required to obtain a written opinion from the examining physician containing the results of the medical examination; the physician's opinion as to whether the employee has any detected medical conditions that would place the employee at an increased risk of exposure-related disease; any recommended limitations on the employee or on the use of personal protective equipment; and a statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions related to asbestos exposure that require further explanation or treatment. This written opinion must not reveal specific findings or diagnoses unrelated to exposure to asbestos and a copy of the opinion must be provided to the affected employee.

[59 FR 40964, Aug. 10, 1994]

• Part Number:	1926
• Part Title:	Safety and Health Regulations for Construction
• Subpart:	Z
• Subpart Title:	Toxic and Hazardous Substances
• Standard Number:	1926.1101 App J
• Title:	Smoking cessation program information for asbestos, non-mandatory

The following organizations provide smoking cessation information.

1. The National Cancer Institute operates a toll-free Cancer Information Service (CIS) with trained personnel to help you. Call 1-800-4-CANCER to reach the CIS offices serving your area or write: Office of Cancer Communications, National Cancer Institute, National Institutes of Health, Building 31, Room 10A24, Bethesda, Maryland, 20892.

2. American Cancer Society, 3340 Peachtree Road, N.E., Atlanta, Georgia 30026, (404)320-3333.

The American Cancer Society (ACS) is a voluntary organization composed of 58 divisions and 3,100 local units. Through "The Great American Smokeout" in November, the annual Cancer Crusade in April, and numerous educational materials, ACS helps people learn about the health hazards of smoking and become successful ex-smokers.

3. American Heart Association, 7320 Greenville Avenue, Dallas, Texas 75231, (214)750-5300.

The American Heart Association (AHA) is a voluntary organization with 130,000 members (physicians, scientists, and laypersons) in 55 state and regional groups. AHA produces a variety of publications and audiovisual materials about the effects of smoking on the heart. AHA also has developed a guidebook for incorporating a weight-control component into smoking cessation programs.

4. American Lung Association, 1740 Broadway, New York, New York 10019, (212)245-8000.

A voluntary organization of 7,500 members (physicians, nurses, and laypersons), the American Lung Association (ALA) conducts numerous public information programs about the health effects of smoking. ALA has 59 state and 85 local units. The organization actively supports legislation and information campaigns for non-smokers' rights and provides help for smokers who want to quit, for example, through "Freedom From Smoking," a self-help smoking cessation program.

5. Office on Smoking and Health, U.S. Department of Health and Human Services, 5600 Fishers Lane, Park Building, Room 110, Rockville, Maryland 20857.

The Office on Smoking and Health (OSH) is the Department of Health and Human Services' lead agency in smoking control. OSH has sponsored distribution of publications on smoking-related topics, such as free flyers on relapse after initial quitting, helping a friend or family member quit smoking, the health hazards of smoking, and the effects of parental smoking on teenagers.

- In Hawaii, on Oahu call 524-1234 (call collect from neighboring islands).

Spanish-speaking staff members are available during daytime hours to callers from the following areas: California, Florida, Georgia, Illinois, New Jersey (area code 201), New York, and Texas. Consult your local telephone directory for listings of local chapters.

[59 FR 40964, Aug. 10, 1994]

- **Part Number:** 1926
 - **Part Title:** Safety and Health Regulations for Construction
 - **Subpart:** Z
 - **Subpart Title:** Toxic and Hazardous Substances
 - **Standard Number:** 1926.1101 App K
 - **Title:** Polarized Light Microscopy of Asbestos - Non-Mandatory
-

Method number:

ID-191

Matrix: Bulk

Collection Procedure:

Collect approximately 1 to 2 grams of each type of material and place into separate 20 mL scintillation vials.

Analytical Procedure:

A portion of each separate phase is analyzed by gross examination, phase-polar examination, and central stop dispersion microscopy.

Commercial manufacturers and products mentioned in this method are for descriptive use only and do not constitute endorsements by USDOL-OSHA. Similar products from other sources may be substituted.

1. Introduction

This method describes the collection and analysis of asbestos bulk materials by light microscopy techniques including phase-polar illumination and central-stop dispersion microscopy. Some terms unique to asbestos analysis are defined below:

Amphibole: A family of minerals whose crystals are formed by long, thin units which have two thin ribbons of double chain silicate with a brucite ribbon in between. The shape of each unit is similar to an "I beam". Minerals important in asbestos analysis include cummingtonite-grunerite, crocidolite, tremolite-actinolite and anthophyllite.

Asbestos: A term for naturally occurring fibrous minerals. Asbestos includes chrysotile, cummingtonite-grunerite asbestos (amosite), anthophyllite asbestos, tremolite asbestos, crocidolite, actinolite asbestos and any of these minerals which have been chemically treated or altered. The precise chemical formulation of each species varies with the location from which it was mined. Nominal compositions are listed:

Chrysotile..... $Mg(3)Si(2)O(5)(OH)(4)$
 Crocidolite (Riebeckite asbestos)
 $Na(2)Fe(3)(2)+Fe(2)(3)+Si(8)O(22)(OH)(2)$
 Cummingtonite-Grunerite asbestos (Amosite)
 $(Mg,Fe)(7)Si(8)O(22)(OH)(2)$
 Tremolite-Actinolite asbestos
 $Ca(2)(Mg,Fe)(5)Si(8)O(22)(OH)(2)$
 Anthophyllite asbestos..... $(Mg,Fe)(7)Si(8)O(22)(OH)(2)$

Asbestos Fiber: A fiber of asbestos meeting the criteria for a fiber. (See section 3.5. of this Appendix)

Aspect Ratio: The ratio of the length of a fiber to its diameter usually defined as "length : width", e.g. 3:1.

Brucite: A sheet mineral with the composition $Mg(OH)(2)$.

Central Stop Dispersion Staining (microscope): This is a dark field microscope technique that images particles using only light refracted by the particle, excluding light that travels through the particle unrefracted. This is

usually accomplished with a McCrone objective or other arrangement which places a circular stop with apparent aperture equal to the objective aperture in the back focal plane of the microscope.

Cleavage Fragments: Mineral particles formed by the comminution of minerals, especially those characterized by relatively parallel sides and moderate aspect ratio.

Differential Counting: The term applied to the practice of excluding certain kinds of fibers from a phase contrast asbestos count because they are not asbestos.

Fiber: A particle longer than or equal to 5 μm with a length to width ratio greater than or equal to 3:1. This may include cleavage fragments. (see section 3.5 of this appendix).

Phase Contrast: Contrast obtained in the microscope by causing light scattered by small particles to destructively interfere with unscattered light, thereby enhancing the visibility of very small particles and particles with very low intrinsic contrast.

Phase Contrast Microscope: A microscope configured with a phase mask pair to create phase contrast. The technique which uses this is called Phase Contrast Microscopy (PCM).

Phase-Polar Analysis: This is the use of polarized light in a phase contrast microscope. It is used to see the same size fibers that are visible in air filter analysis. Although fibers finer than 1 μm are visible, analysis of these is inferred from analysis of larger bundles that are usually present.

Phase-Polar Microscope: The phase-polar microscope is a phase contrast microscope which has an analyzer, a polarizer, a first order red plate and a rotating phase condenser all in place so that the polarized light image is enhanced by phase contrast.

Sealing Encapsulant: This is a product which can be applied, preferably by spraying, onto an asbestos surface which will seal the surface so that fibers cannot be released.

Serpentine: A mineral family consisting of minerals with the general composition $\text{Mg}_3(\text{Si}_2\text{O}_5)(\text{OH})_4$ having the magnesium in brucite layer over a silicate layer. Minerals important in asbestos analysis included in this family are chrysotile, lizardite, antigorite.

1.1. History

Light microscopy has been used for well over 100 years for the determination of mineral species. This analysis is carried out using specialized polarizing microscopes as well as bright field microscopes. The identification of minerals is an on-going process with many new minerals described each year. The first recorded use of asbestos was in Finland about 2500 B.C. where the material was used in the mud wattle for the wooden huts the people lived in as well as strengthening for pottery. Adverse health aspects of the mineral were noted nearly 2000 years ago when Pliny the Younger wrote about the poor health of slaves in the asbestos mines. Although known to be injurious for centuries, the first modern references to its toxicity were by the British Labor Inspectorate when it banned asbestos dust from the workplace in 1898. Asbestosis cases were described in the literature after the turn of the century. Cancer was first suspected in the mid 1930's and a causal link to mesothelioma was made in 1965. Because of the public concern for worker and public safety with the use of this material, several different types of analysis were applied to the determination of asbestos content. Light microscopy requires a great deal of experience and craft. Attempts were made to apply less subjective methods to the analysis. X-ray diffraction was partially successful in determining the mineral types but was unable to separate out the fibrous portions from the non-fibrous portions. Also, the minimum detection limit for asbestos analysis by X-ray diffraction (XRD) is about 1%. Differential Thermal Analysis (DTA) was no more successful. These provide useful corroborating information when the presence of asbestos has been shown by microscopy; however, neither can determine the difference between fibrous and non-fibrous minerals when both habits are present. The same is true of Infrared Absorption

(IR).

When electron microscopy was applied to asbestos analysis, hundreds of fibers were discovered present too small to be visible in any light microscope. There are two different types of electron microscope used for asbestos analysis: Scanning Electron Microscope (SEM) and Transmission Electron Microscope (TEM). Scanning Electron Microscopy is useful in identifying minerals. The SEM can provide two of the three pieces of information required to identify fibers by electron microscopy: morphology and chemistry. The third is structure as determined by Selected Area Electron Diffraction -- SAED which is performed in the TEM. Although the resolution of the SEM is sufficient for very fine fibers to be seen, accuracy of chemical analysis that can be performed on the fibers varies with fiber diameter in fibers of less than 0.2 μm diameter. The TEM is a powerful tool to identify fibers too small to be resolved by light microscopy and should be used in conjunction with this method when necessary. The TEM can provide all three pieces of information required for fiber identification. Most fibers thicker than 1 μm can adequately be defined in the light microscope. The light microscope remains as the best instrument for the determination of mineral type. This is because the minerals under investigation were first described analytically with the light microscope. It is inexpensive and gives positive identification for most samples analyzed. Further, when optical techniques are inadequate, there is ample indication that alternative techniques should be used for complete identification of the sample.

1.2. Principle

Minerals consist of atoms that may be arranged in random order or in a regular arrangement. Amorphous materials have atoms in random order while crystalline materials have long range order. Many materials are transparent to light, at least for small particles or for thin sections. The properties of these materials can be investigated by the effect that the material has on light passing through it. The six asbestos minerals are all crystalline with particular properties that have been identified and cataloged. These six minerals are anisotropic. They have a regular array of atoms, but the arrangement is not the same in all directions. Each major direction of the crystal presents a different regularity. Light photons traveling in each of these main directions will encounter different electrical neighborhoods, affecting the path and time of travel. The techniques outlined in this method use the fact that light traveling through fibers or crystals in different directions will behave differently, but predictably. The behavior of the light as it travels through a crystal can be measured and compared with known or determined values to identify the mineral species. Usually, Polarized Light Microscopy (PLM) is performed with strain-free objectives on a bright-field microscope platform. This would limit the resolution of the microscope to about 0.4 μm . Because OSHA requires the counting and identification of fibers visible in phase contrast, the phase contrast platform is used to visualize the fibers with the polarizing elements added into the light path. Polarized light methods cannot identify fibers finer than about 1 μm in diameter even though they are visible. The finest fibers are usually identified by inference from the presence of larger, identifiable fiber bundles. When fibers are present, but not identifiable by light microscopy, use either SEM or TEM to determine the fiber identity.

1.3. Advantages and Disadvantages

The advantages of light microscopy are:

- (a) Basic identification of the materials was first performed by light microscopy and gross analysis. This provides a large base of published information against which to check analysis and analytical technique.
- (b) The analysis is specific to fibers. The minerals present can exist in asbestiform, fibrous, prismatic, or massive varieties all at the same time. Therefore, bulk methods of analysis such as X-ray diffraction, IR analysis, DTA, etc. are inappropriate where the material is not known to be fibrous.
- (c) The analysis is quick, requires little preparation time, and can be performed on-site if a suitably equipped microscope is available.

The disadvantages are:

(a) Even using phase-polar illumination, not all the fibers present may be seen. This is a problem for very low asbestos concentrations where agglomerations or large bundles of fibers may not be present to allow identification by inference.

(b) The method requires a great degree of sophistication on the part of the microscopist. An analyst is only as useful as his mental catalog of images. Therefore, a microscopist's accuracy is enhanced by experience. The mineralogical training of the analyst is very important. It is the basis on which subjective decisions are made.

(c) The method uses only a tiny amount of material for analysis. This may lead to sampling bias and false results (high or low). This is especially true if the sample is severely inhomogeneous.

(d) Fibers may be bound in a matrix and not distinguishable as fibers so identification cannot be made.

1.4. Method Performance

1.4.1. This method can be used for determination of asbestos content from 0 to 100% asbestos. The detection limit has not been adequately determined, although for selected samples, the limit is very low, depending on the number of particles examined. For mostly homogeneous, finely divided samples, with no difficult fibrous interferences, the detection limit is below 1%. For inhomogeneous samples (most samples), the detection limit remains undefined. NIST has conducted proficiency testing of laboratories on a national scale. Although each round is reported statistically with an average, control limits, etc., the results indicate a difficulty in establishing precision especially in the low concentration range. It is suspected that there is significant bias in the low range especially near 1%. EPA tried to remedy this by requiring a mandatory point counting scheme for samples less than 10%. The point counting procedure is tedious, and may introduce significant biases of its own. It has not been incorporated into this method.

1.4.2. The precision and accuracy of the quantitation tests performed in this method are unknown. Concentrations are easier to determine in commercial products where asbestos was deliberately added because the amount is usually more than a few percent. An analyst's results can be "calibrated" against the known amounts added by the manufacturer. For geological samples, the degree of homogeneity affects the precision.

1.4.3. The performance of the method is analyst dependent. The analyst must choose carefully and not necessarily randomly the portions for analysis to assure that detection of asbestos occurs when it is present. For this reason, the analyst must have adequate training in sample preparation, and experience in the location and identification of asbestos in samples. This is usually accomplished through substantial on-the-job training as well as formal education in mineralogy and microscopy.

1.5. Interferences

Any material which is long, thin, and small enough to be viewed under the microscope can be considered an interference for asbestos. There are literally hundreds of interferences in workplaces. The techniques described in this method are normally sufficient to eliminate the interferences. An analyst's success in eliminating the interferences depends on proper training.

Asbestos minerals belong to two mineral families: the serpentines and the amphiboles. In the serpentine family, the only common fibrous mineral is chrysotile. Occasionally, the mineral antigorite occurs in a fibril habit with morphology similar to the amphiboles. The amphibole minerals consist of a score of different minerals of which only five are regulated by federal standard: amosite, crocidolite, anthophyllite asbestos, tremolite asbestos and actinolite asbestos. These are the only amphibole minerals that have been commercially exploited for their fibrous properties; however, the rest can and do occur occasionally in asbestiform habit.

In addition to the related mineral interferences, other minerals common in building material may present a problem for some microscopists: gypsum, anhydrite, brucite, quartz fibers, talc fibers or ribbons, wollastonite, perlite, attapulgite, etc. Other fibrous materials commonly present in workplaces are: fiberglass, mineral wool,

ceramic wool, refractory ceramic fibers, kevlar, nomex, synthetic fibers, graphite or carbon fibers, cellulose (paper or wood) fibers, metal fibers, etc.

Matrix embedding material can sometimes be a negative interference. The analyst may not be able to easily extract the fibers from the matrix in order to use the method. Where possible, remove the matrix before the analysis, taking careful note of the loss of weight. Some common matrix materials are: vinyl, rubber, tar, paint, plant fiber, cement, and epoxy. A further negative interference is that the asbestos fibers themselves may be either too small to be seen in Phase contrast Microscopy (PCM) or of a very low fibrous quality, having the appearance of plant fibers. The analyst's ability to deal with these materials increases with experience.

1.6. Uses and Occupational Exposure

Asbestos is ubiquitous in the environment. More than 40% of the land area of the United States is composed of minerals which may contain asbestos. Fortunately, the actual formation of great amounts of asbestos is relatively rare. Nonetheless, there are locations in which environmental exposure can be severe such as in the Serpentine Hills of California.

There are thousands of uses for asbestos in industry and the home. Asbestos abatement workers are the most current segment of the population to have occupational exposure to great amounts of asbestos. If the material is undisturbed, there is no exposure. Exposure occurs when the asbestos-containing material is abraded or otherwise disturbed during maintenance operations or some other activity. Approximately 95% of the asbestos in place in the United States is chrysotile.

Amosite and crocidolite make up nearly all the difference. Tremolite and anthophyllite make up a very small percentage. Tremolite is found in extremely small amounts in certain chrysotile deposits. Actinolite exposure is probably greatest from environmental sources, but has been identified in vermiculite containing, sprayed-on insulating materials which may have been certified as asbestos-free.

1.7. Physical and Chemical Properties

The nominal chemical compositions for the asbestos minerals were given in Section 1. Compared to cleavage fragments of the same minerals, asbestiform fibers possess a high tensile strength along the fiber axis. They are chemically inert, non-combustible, and heat resistant. Except for chrysotile, they are insoluble in Hydrochloric acid (HCl). Chrysotile is slightly soluble in HCl. Asbestos has high electrical resistance and good sound absorbing characteristics. It can be woven into cables, fabrics or other textiles, or matted into papers, felts, and mats.

1.8. Toxicology (This Section is for Information Only and Should Not Be Taken as OSHA Policy)

Possible physiologic results of respiratory exposure to asbestos are mesothelioma of the pleura or peritoneum, interstitial fibrosis, asbestosis, pneumoconiosis, or respiratory cancer. The possible consequences of asbestos exposure are detailed in the NIOSH Criteria Document or in the OSHA Asbestos Standards 29 CFR 1910.1001 and 29 CFR 1926.1101 and 29 CFR 1915.1001.

2. Sampling Procedure

2.1. Equipment for sampling

- (a) Tube or cork borer sampling device
- (b) Knife
- (c) 20 mL scintillation vial or similar vial

(d) Sealing encapsulant

2.2. Safety Precautions

Asbestos is a known carcinogen. Take care when sampling. While in an asbestos-containing atmosphere, a properly selected and fit-tested respirator should be worn. Take samples in a manner to cause the least amount of dust. Follow these general guidelines:

- (a) Do not make unnecessary dust.
- (b) Take only a small amount (1 to 2 g).
- (c) Tightly close the sample container.
- (d) Use encapsulant to seal the spot where the sample was taken, if necessary.

2.3. Sampling Procedure

Samples of any suspect material should be taken from an inconspicuous place. Where the material is to remain, seal the sampling wound with an encapsulant to eliminate the potential for exposure from the sample site. Microscopy requires only a few milligrams of material. The amount that will fill a 20 mL scintillation vial is more than adequate. Be sure to collect samples from all layers and phases of material. If possible, make separate samples of each different phase of the material. This will aid in determining the actual hazard. **DO NOT USE ENVELOPES, PLASTIC OR PAPER BAGS OF ANY KIND TO COLLECT SAMPLES.** The use of plastic bags presents a contamination hazard to laboratory personnel and to other samples. When these containers are opened, a bellows effect blows fibers out of the container onto everything, including the person opening the container.

If a cork-borer type sampler is available, push the tube through the material all the way, so that all layers of material are sampled. Some samplers are intended to be disposable. These should be capped and sent to the laboratory. If a non-disposable cork borer is used, empty the contents into a scintillation vial and send to the laboratory. Vigorously and completely clean the cork borer between samples.

2.4 Shipment

Samples packed in glass vials must not touch or they might break in shipment.

- (a) Seal the samples with a sample seal over the end to guard against tampering and to identify the sample.
- (b) Package the bulk samples in separate packages from the air samples. They may cross-contaminate each other and will invalidate the results of the air samples.
- (c) Include identifying paperwork with the samples, but not in contact with the suspected asbestos.
- (d) To maintain sample accountability, ship the samples by certified mail, overnight express, or hand carry them to the laboratory.

3. Analysis

The analysis of asbestos samples can be divided into two major parts: sample preparation and microscopy. Because of the different asbestos uses that may be encountered by the analyst, each sample may need different preparation steps. The choices are outlined below. There are several different tests that are performed to identify

the asbestos species and determine the percentage. They will be explained below.

3.1. Safety

- (a) Do not create unnecessary dust. Handle the samples in HEPA-filter equipped hoods. If samples are received in bags, envelopes or other inappropriate container, open them only in a hood having a face velocity at or greater than 100 fpm. Transfer a small amount to a scintillation vial and only handle the smaller amount.
- (b) Open samples in a hood, never in the open lab area.
- (c) Index of refraction oils can be toxic. Take care not to get this material on the skin. Wash immediately with soap and water if this happens.
- (d) Samples that have been heated in the muffle furnace or the drying oven may be hot. Handle them with tongs until they are cool enough to handle.
- (e) Some of the solvents used, such as THF (tetrahydrofuran), are toxic and should only be handled in an appropriate fume hood and according to instructions given in the Material Safety Data Sheet (MSDS).

3.2. Equipment

- (a) Phase contrast microscope with 10x, 16x and 40x objectives, 10x wide-field eyepieces, G-22 Walton-Beckett graticule, Whipple disk, polarizer, analyzer and first order red or gypsum plate, 100 Watt illuminator, rotating position condenser with oversize phase rings, central stop dispersion objective, Kohler illumination and a rotating mechanical stage.
- (b) Stereo microscope with reflected light illumination, transmitted light illumination, polarizer, analyzer and first order red or gypsum plate, and rotating stage.
- (c) Negative pressure hood for the stereo microscope
- (d) Muffle furnace capable of 600 deg.C
- (e) Drying oven capable of 50 -- 150 deg.C
- (f) Aluminum specimen pans
- (g) Tongs for handling samples in the furnace
- (h) High dispersion index of refraction oils (Special for dispersion staining.)

n = 1.550
n = 1.585
n = 1.590
n = 1.605
n = 1.620
n = 1.670
n = 1.680
n = 1.690

- (i) A set of index of refraction oils from about n = 1.350 to n = 2.000 in n = 0.005 increments. (Standard for

Becke line analysis.)

(j) Glass slides with painted or frosted ends 1x3 inches 1mm (thick, precleaned.)

(k) Cover Slips 22x22 mm, #1 1/2

(l) Paper clips or dissection needles

(m) Hand grinder

(n) Scalpel with both #10 and #11 blades

(o) 0.1 molar HCl

(p) Decalcifying solution (Baxter Scientific Products) Ethylenediaminetetraacetic Acid,

Tetrasodium	0.7 g/l
Sodium Potassium Tartrate	8.0 mg/liter
Hydrochloric Acid	99.2 g/liter
Sodium Tartrate	0.14 g/liter

(q) Tetrahydrofuran (THF)

(r) Hotplate capable of 60 deg.C

(s) Balance

(t) Hacksaw blade

(u) Ruby mortar and pestle

3.3. Sample Pre-Preparation

Sample preparation begins with pre-preparation which may include chemical reduction of the matrix, heating the sample to dryness or heating in the muffle furnace. The end result is a sample which has been reduced to a powder that is sufficiently fine to fit under the cover slip. Analyze different phases of samples separately, e.g., tile and the tile mastic should be analyzed separately as the mastic may contain asbestos while the tile may not.

(a) Wet Samples

Samples with a high water content will not give the proper dispersion colors and must be dried prior to sample mounting. Remove the lid of the scintillation vial, place the bottle in the drying oven and heat at 100 deg.C to dryness (usually about 2 h). Samples which are not submitted to the lab in glass must be removed and placed in glass vials or aluminum weighing pans before placing them in the drying oven.

(b) Samples With Organic Interference -- Muffle Furnace

These may include samples with tar as a matrix, vinyl asbestos tile, or any other organic that can be reduced by heating. Remove the sample from the vial and weigh in a balance to determine the weight of the submitted portion. Place the sample in a muffle furnace at 500 deg.C for 1 to 2 h or until all obvious organic material has been removed. Retrieve, cool and weigh again to determine the weight loss on ignition. This is necessary to

determine the asbestos content of the submitted sample, because the analyst will be looking at a reduced sample.

Note: Heating above 600 deg.C will cause the sample to undergo a structural change which, given sufficient time, will convert the chrysotile to forsterite. Heating even at lower temperatures for 1 to 2 h may have a measurable effect on the optical properties of the minerals. If the analyst is unsure of what to expect, a sample of standard asbestos should be heated to the same temperature for the same length of time so that it can be examined for the proper interpretation.

(c) Samples With Organic Interference -- THF

Vinyl asbestos tile is the most common material treated with this solvent, although, substances containing tar will sometimes yield to this treatment. Select a portion of the material and then grind it up if possible. Weigh the sample and place it in a test tube. Add sufficient THF to dissolve the organic matrix. This is usually about 4 to 5 mL. Remember, THF is highly flammable. Filter the remaining material through a tared silver membrane, dry and weigh to determine how much is left after the solvent extraction. Further process the sample to remove carbonate or mount directly.

(d) Samples With Carbonate Interference

Carbonate material is often found on fibers and sometimes must be removed in order to perform dispersion microscopy. Weigh out a portion of the material and place it in a test tube. Add a sufficient amount of 0.1 M HCl or decalcifying solution in the tube to react all the carbonate as evidenced by gas formation; i.e., when the gas bubbles stop, add a little more solution. If no more gas forms, the reaction is complete. Filter the material out through a tared silver membrane, dry and weigh to determine the weight lost.

3.4. Sample Preparation

Samples must be prepared so that accurate determination can be made of the asbestos type and amount present. The following steps are carried out in the low-flow hood (a low-flow hood has less than 50 fpm flow):

(1) If the sample has large lumps, is hard, or cannot be made to lie under a cover slip, the grain size must be reduced. Place a small amount between two slides and grind the material between them or grind a small amount in a clean mortar and pestle. The choice of whether to use an alumina, ruby, or diamond mortar depends on the hardness of the material. Impact damage can alter the asbestos mineral if too much mechanical shock occurs. (Freezer mills can completely destroy the observable crystallinity of asbestos and should not be used). For some samples, a portion of material can be shaved off with a scalpel, ground off with a hand grinder or hack saw blade.

The preparation tools should either be disposable or cleaned thoroughly. Use vigorous scrubbing to loosen the fibers during the washing. Rinse the implements with copious amounts of water and air-dry in a dust-free environment.

(2) If the sample is powder or has been reduced as in (1) above, it is ready to mount. Place a glass slide on a piece of optical tissue and write the identification on the painted or frosted end. Place two drops of index of refraction medium $n = 1.550$ on the slide. (The medium $n = 1.550$ is chosen because it is the matching index for chrysotile. Dip the end of a clean paper-clip or dissecting needle into the droplet of refraction medium on the slide to moisten it. Then dip the probe into the powder sample. Transfer what sticks on the probe to the slide. The material on the end of the probe should have a diameter of about 3 mm for a good mount. If the material is very fine, less sample may be appropriate. For non-powder samples such as fiber mats, forceps should be used to transfer a small amount of material to the slide. Stir the material in the medium on the slide, spreading it out and making the preparation as uniform as possible. Place a cover-slip on the preparation by gently lowering onto the slide and allowing it to fall "trapdoor" fashion on the preparation to push out any bubbles. Press gently on the cover slip to even out the distribution of particulate on the slide. If there is insufficient mounting oil on the slide, one or two drops may be placed near the edge of the coverslip on the slide. Capillary action will draw the

necessary amount of liquid into the preparation. Remove excess oil with the point of a laboratory wiper.

Treat at least two different areas of each phase in this fashion. Choose representative areas of the sample. It may be useful to select particular areas or fibers for analysis. This is useful to identify asbestos in severely inhomogeneous samples.

When it is determined that amphiboles may be present, repeat the above process using the appropriate high-dispersion oils until an identification is made or all six asbestos minerals have been ruled out. Note that percent determination must be done in the index medium 1.550 because amphiboles tend to disappear in their matching mediums.

3.5. Analytical procedure

Note: This method presumes some knowledge of mineralogy and optical petrography.

The analysis consists of three parts: The determination of whether there is asbestos present, what type is present and the determination of how much is present. The general flow of the analysis is:

- (1) Gross examination.
- (2) Examination under polarized light on the stereo microscope.
- (3) Examination by phase-polar illumination on the compound phase microscope.
- (4) Determination of species by dispersion stain. Examination by Becke line analysis may also be used; however, this is usually more cumbersome for asbestos determination.
- (5) Difficult samples may need to be analyzed by SEM or TEM, or the results from those techniques combined with light microscopy for a definitive identification.

Identification of a particle as asbestos requires that it be asbestiform. Description of particles should follow the suggestion of Campbell. (Figure 1)

(For Figure 1 of Asbestos Particles, [Click Here](#))

For the purpose of regulation, the mineral must be one of the six minerals covered and must be in the asbestos growth habit. Large specimen samples of asbestos generally have the gross appearance of wood. Fibers are easily parted from it. Asbestos fibers are very long compared with their widths. The fibers have a very high tensile strength as demonstrated by bending without breaking. Asbestos fibers exist in bundles that are easily parted, show longitudinal fine structure and may be tufted at the ends showing "bundle of sticks" morphology. In the microscope some of these properties may not be observable. Amphiboles do not always show striations along their length even when they are asbestos. Neither will they always show tufting. They generally do not show a curved nature except for very long fibers. Asbestos and asbestiform minerals are usually characterized in groups by extremely high aspect ratios (greater than 100:1). While aspect ratio analysis is useful for characterizing populations of fibers, it cannot be used to identify individual fibers of intermediate to short aspect ratio. Observation of many fibers is often necessary to determine whether a sample consists of "cleavage fragments" or of asbestos fibers.

Most cleavage fragments of the asbestos minerals are easily distinguishable from true asbestos fibers. This is because true cleavage fragments usually have larger diameters than 1 μm . Internal structure of particles larger than this usually shows them to have no internal fibrillar structure. In addition, cleavage fragments of the monoclinic amphiboles show inclined extinction under crossed polars with no compensator. Asbestos fibers usually

show extinction at zero degrees or ambiguous extinction if any at all. Morphologically, the larger cleavage fragments are obvious by their blunt or stepped ends showing prismatic habit. Also, they tend to be acicular rather than filiform.

Where the particles are less than 1 um in diameter and have an aspect ratio greater than or equal to 3:1, it is recommended that the sample be analyzed by SEM or TEM if there is any question whether the fibers are cleavage fragments or asbestiform particles.

Care must be taken when analyzing by electron microscopy because the interferences are different from those in light microscopy and may structurally be very similar to asbestos. The classic interference is between anthophyllite and biopyribole or intermediate fiber. Use the same morphological clues for electron microscopy as are used for light microscopy, e.g. fibril splitting, internal longitudinal striation, fraying, curvature, etc.

(1) Gross examination:

Examine the sample, preferably in the glass vial. Determine the presence of any obvious fibrous component. Estimate a percentage based on previous experience and current observation. Determine whether any pre-preparation is necessary. Determine the number of phases present. This step may be carried out or augmented by observation at 6 to 40 x under a stereo microscope.

(2) After performing any necessary pre-preparation, prepare slides of each phase as described above. Two preparations of the same phase in the same index medium can be made side-by-side on the same glass for convenience. Examine with the polarizing stereo microscope. Estimate the percentage of asbestos based on the amount of birefringent fiber present.

(3) Examine the slides on the phase-polar microscopes at magnifications of 160 and 400 x . Note the morphology of the fibers. Long, thin, very straight fibers with little curvature are indicative of fibers from the amphibole family. Curved, wavy fibers are usually indicative of chrysotile. Estimate the percentage of asbestos on the phase-polar microscope under conditions of crossed polars and a gypsum plate. Fibers smaller than 1.0 um in thickness must be identified by inference to the presence of larger, identifiable fibers and morphology. If no larger fibers are visible, electron microscopy should be performed. At this point, only a tentative identification can be made. Full identification must be made with dispersion microscopy. Details of the tests are included in the appendices.

(4) Once fibers have been determined to be present, they must be identified. Adjust the microscope for dispersion mode and observe the fibers. The microscope has a rotating stage, one polarizing element, and a system for generating dark-field dispersion microscopy (see Section 4.6. of this appendix). Align a fiber with its length parallel to the polarizer and note the color of the Becke lines. Rotate the stage to bring the fiber length perpendicular to the polarizer and note the color. Repeat this process for every fiber or fiber bundle examined. The colors must be consistent with the colors generated by standard asbestos reference materials for a positive identification. In $n = 1.550$, amphiboles will generally show a yellow to straw-yellow color indicating that the fiber indices of refraction are higher than the liquid. If long, thin fibers are noted and the colors are yellow, prepare further slides as above in the suggested matching liquids listed below:

Type of asbestos	Index of refraction
Chrysotile.....	$n = 1.550.$
Amosite.....	$n = 1.670 \text{ r } 1.680.$
Crocidolite.....	$n = 1.690.$
Anthophyllite.....	$n = 1.605 \text{ nd } 1.620.$
Tremolite.....	$n = 1.605 \text{ and } 1.620.$
Actinolite.....	$n = 1.620.$

Where more than one liquid is suggested, the first is preferred; however, in some cases this liquid will not give good dispersion color. Take care to avoid interferences in the other liquid; e.g., wollastonite in $n = 1.620$ will give the same colors as tremolite. In $n = 1.605$ wollastonite will appear yellow in all directions. Wollastonite may be determined under crossed polars as it will change from blue to yellow as it is rotated along its fiber axis by tapping on the cover slip. Asbestos minerals will not change in this way.

Determination of the angle of extinction may, when present, aid in the determination of anthophyllite from tremolite. True asbestos fibers usually have 0 deg. extinction or ambiguous extinction, while cleavage fragments have more definite extinction.

Continue analysis until both preparations have been examined and all present species of asbestos are identified. If there are no fibers present, or there is less than 0.1% present, end the analysis with the minimum number of slides (2).

(5) Some fibers have a coating on them which makes dispersion microscopy very difficult or impossible. Becke line analysis or electron microscopy may be performed in those cases. Determine the percentage by light microscopy. TEM analysis tends to overestimate the actual percentage present.

(6) Percentage determination is an estimate of occluded area, tempered by gross observation. Gross observation information is used to make sure that the high magnification microscopy does not greatly over- or under-estimate the amount of fiber present. This part of the analysis requires a great deal of experience. Satisfactory models for asbestos content analysis have not yet been developed, although some models based on metallurgical grain-size determination have found some utility. Estimation is more easily handled in situations where the grain sizes visible at about 160 x are about the same and the sample is relatively homogeneous.

View all of the area under the cover slip to make the percentage determination. View the fields while moving the stage, paying attention to the clumps of material. These are not usually the best areas to perform dispersion microscopy because of the interference from other materials. But, they are the areas most likely to represent the accurate percentage in the sample. Small amounts of asbestos require slower scanning and more frequent analysis of individual fields.

Report the area occluded by asbestos as the concentration. This estimate does not generally take into consideration the difference in density of the different species present in the sample. For most samples this is adequate. Simulation studies with similar materials must be carried out to apply microvisual estimation for that purpose and is beyond the scope of this procedure.

(7) Where successive concentrations have been made by chemical or physical means, the amount reported is the percentage of the material in the "as submitted" or original state. The percentage determined by microscopy is multiplied by the fractions remaining after pre-preparation steps to give the percentage in the original sample. For example:

Step 1. 60% remains after heating at 550 deg.C for 1 h.

Step 2. 30% of the residue of step 1 remains after dissolution of carbonate in 0.1 m HCl.

Step 3. Microvisual estimation determines that 5% of the sample is chrysotile asbestos.

The reported result is:

$R = (\text{Microvisual result in percent}) \times (\text{Fraction remaining after step 2}) \times (\text{Fraction remaining of original sample after step 1})$

$$R = (5) \times (.30) \times (.60) = 0.9\%$$

(8) Report the percent and type of asbestos present. For samples where asbestos was identified, but is less than 1.0%, report "Asbestos present, less than 1.0%." There must have been at least two observed fibers or fiber bundles in the two preparations to be reported as present. For samples where asbestos was not seen, report as "None Detected."

Auxiliary Information

Because of the subjective nature of asbestos analysis, certain concepts and procedures need to be discussed in more depth. This information will help the analyst understand why some of the procedures are carried out the way they are.

4.1. Light

Light is electromagnetic energy. It travels from its source in packets called quanta. It is instructive to consider light as a plane wave. The light has a direction of travel. Perpendicular to this and mutually perpendicular to each other, are two vector components. One is the magnetic vector and the other is the electric vector. We shall only be concerned with the electric vector. In this description, the interaction of the vector and the mineral will describe all the observable phenomena. From a light source such a microscope illuminator, light travels in all different direction from the filament.

In any given direction away from the filament, the electric vector is perpendicular to the direction of travel of a light ray. While perpendicular, its orientation is random about the travel axis. If the electric vectors from all the light rays were lined up by passing the light through a filter that would only let light rays with electric vectors oriented in one direction pass, the light would then be POLARIZED.

Polarized light interacts with matter in the direction of the electric vector. This is the polarization direction. Using this property it is possible to use polarized light to probe different materials and identify them by how they interact with light.

The speed of light in a vacuum is a constant at about 2.99×10^8 m/s. When light travels in different materials such as air, water, minerals or oil, it does not travel at this speed. It travels slower. This slowing is a function of both the material through which the light is traveling and the wavelength or frequency of the light. In general, the more dense the material, the slower the light travels. Also, generally, the higher the frequency, the slower the light will travel. The ratio of the speed of light in a vacuum to that in a material is called the index of refraction (n). It is usually measured at 589 nm (the sodium D line). If white light (light containing all the visible wavelengths) travels through a material, rays of longer wavelengths will travel faster than those of shorter wavelengths, this separation is called dispersion. Dispersion is used as an identifier of materials as described in Section 4.6.

4.2. Material Properties

Materials are either amorphous or crystalline. The difference between these two descriptions depends on the positions of the atoms in them. The atoms in amorphous materials are randomly arranged with no long range order. An example of an amorphous material is glass. The atoms in crystalline materials, on the other hand, are in regular arrays and have long range order. Most of the atoms can be found in highly predictable locations. Examples of crystalline material are salt, gold, and the asbestos minerals.

It is beyond the scope of this method to describe the different types of crystalline materials that can be found, or the full description of the classes into which they can fall. However, some general crystallography is provided

below to give a foundation to the procedures described.

With the exception of anthophyllite, all the asbestos minerals belong to the monoclinic crystal type. The unit cell is the basic repeating unit of the crystal and for monoclinic crystals can be described as having three unequal sides, two 90 deg. angles and one angle not equal to 90 deg.. The orthorhombic group, of which anthophyllite is a member has three unequal sides and three 90 deg. angles. The unequal sides are a consequence of the complexity of fitting the different atoms into the unit cell. Although the atoms are in a regular array, that array is not symmetrical in all directions. There is long range order in the three major directions of the crystal. However, the order is different in each of the three directions. This has the effect that the index of refraction is different in each of the three directions. Using polarized light, we can investigate the index of refraction in each of the directions and identify the mineral or material under investigation. The indices alpha, beta, and gamma are used to identify the lowest, middle, and highest index of refraction respectively. The x direction, associated with alpha is called the fast axis. Conversely, the z direction is associated with gamma and is the slow direction. Crocidolite has alpha along the fiber length making it "length-fast". The remainder of the asbestos minerals have the gamma axis along the fiber length. They are called "length-slow". This orientation to fiber length is used to aid in the identification of asbestos.

4.3. Polarized Light Technique

Polarized light microscopy as described in this section uses the phase-polar microscope described in Section 3.2. A phase contrast microscope is fitted with two polarizing elements, one below and one above the sample. The polarizers have their polarization directions at right angles to each other. Depending on the tests performed, there may be a compensator between these two polarizing elements. A compensator is a piece of mineral with known properties that "compensates" for some deficiency in the optical train. Light emerging from a polarizing element has its electric vector pointing in the polarization direction of the element. The light will not be subsequently transmitted through a second element set at a right angle to the first element. Unless the light is altered as it passes from one element to the other, there is no transmission of light.

4.4. Angle of Extinction

Crystals which have different crystal regularity in two or three main directions are said to be anisotropic. They have a different index of refraction in each of the main directions. When such a crystal is inserted between the crossed polars, the field of view is no longer dark but shows the crystal in color. The color depends on the properties of the crystal. The light acts as if it travels through the crystal along the optical axes. If a crystal optical axis were lined up along one of the polarizing directions (either the polarizer or the analyzer) the light would appear to travel only in that direction, and it would blink out or go dark. The difference in degrees between the fiber direction and the angle at which it blinks out is called the angle of extinction. When this angle can be measured, it is useful in identifying the mineral. The procedure for measuring the angle of extinction is to first identify the polarization direction in the microscope. A commercial alignment slide can be used to establish the polarization directions or use anthophyllite or another suitable mineral. This mineral has a zero degree angle of extinction and will go dark to extinction as it aligns with the polarization directions. When a fiber of anthophyllite has gone to extinction, align the eyepiece reticle or graticule with the fiber so that there is a visual cue as to the direction of polarization in the field of view. Tape or otherwise secure the eyepiece in this position so it will not shift.

After the polarization direction has been identified in the field of view, move the particle of interest to the center of the field of view and align it with the polarization direction. For fibers, align the fiber along this direction. Note the angular reading of the rotating stage. Looking at the particle, rotate the stage until the fiber goes dark or "blinks out". Again note the reading of the stage. The difference in the first reading and the second is an angle of extinction.

The angle measured may vary as the orientation of the fiber changes about its long axis. Tables of mineralogical data usually report the maximum angle of extinction. Asbestos forming minerals, when they exhibit an angle of extinction, usually do show an angle of extinction close to the reported maximum, or as appropriate depending on

the substitution chemistry.

4.5. Crossed Polars with Compensator

When the optical axes of a crystal are not lined up along one of the polarizing directions (either the polarizer or the analyzer) part of the light travels along one axis and part travels along the other visible axis. This is characteristic of birefringent materials.

The color depends on the difference of the two visible indices of refraction and the thickness of the crystal. The maximum difference available is the difference between the alpha and the gamma axes. This maximum difference is usually tabulated as the birefringence of the crystal.

For this test, align the fiber at 45 deg. to the polarization directions in order to maximize the contribution to each of the optical axes. The colors seen are called retardation colors. They arise from the recombination of light which has traveled through the two separate directions of the crystal. One of the rays is retarded behind the other since the light in that direction travels slower. On recombination, some of the colors which make up white light are enhanced by constructive interference and some are suppressed by destructive interference. The result is a color dependent on the difference between the indices and the thickness of the crystal. The proper colors, thicknesses, and retardations are shown on a Michel-Levy chart. The three items, retardation, thickness and birefringence are related by the following relationship:

$$R = t(n(\text{gamma}) - n(\text{alpha}))$$

R = retardation, t = crystal thickness in um, and
n(alpha, gamma) = indices of refraction.

Examination of the equation for asbestos minerals reveals that the visible colors for almost all common asbestos minerals and fiber sizes are shades of gray and black. The eye is relatively poor at discriminating different shades of gray. It is very good at discriminating different colors. In order to compensate for the low retardation, a compensator is added to the light train between the polarization elements. The compensator used for this test is a gypsum plate of known thickness and birefringence. Such a compensator when oriented at 45 deg. to the polarizer direction, provides a retardation of 530 nm of the 530 nm wavelength color. This enhances the red color and gives the background a characteristic red to red-magenta color. If this "full-wave" compensator is in place when the asbestos preparation is inserted into the light train, the colors seen on the fibers are quite different. Gypsum, like asbestos has a fast axis and a slow axis. When a fiber is aligned with its fast axis in the same direction as the fast axis of the gypsum plate, the ray vibrating in the slow direction is retarded by both the asbestos and the gypsum. This results in a higher retardation than would be present for either of the two minerals. The color seen is a second order blue. When the fiber is rotated 90 deg. using the rotating stage, the slow direction of the fiber is now aligned with the fast direction of the gypsum and the fast direction of the fiber is aligned with the slow direction of the gypsum. Thus, one ray vibrates faster in the fast direction of the gypsum, and slower in the slow direction of the fiber; the other ray will vibrate slower in the slow direction of the gypsum and faster in the fast direction of the fiber. In this case, the effect is subtractive and the color seen is a first order yellow. As long as the fiber thickness does not add appreciably to the color, the same basic colors will be seen for all asbestos types except crocidolite. In crocidolite the colors will be weaker, may be in the opposite directions, and will be altered by the blue absorption color natural to crocidolite. Hundreds of other materials will give the same colors as asbestos, and therefore, this test is not definitive for asbestos. The test is useful in discriminating against fiberglass or other amorphous fibers such as some synthetic fibers. Certain synthetic fibers will show retardation colors different than asbestos; however, there are some forms of polyethylene and aramid which will show morphology and retardation colors similar to asbestos minerals. This test must be supplemented with a positive identification test when birefringent fibers are present which can not be excluded by morphology. This test is relatively ineffective for use on fibers less than 1 um in diameter. For positive confirmation TEM or SEM should be used if no larger bundles or fibers are visible.

4.6. Dispersion Staining

Dispersion microscopy or dispersion staining is the method of choice for the identification of asbestos in bulk materials. Becke line analysis is used by some laboratories and yields the same results as does dispersion staining for asbestos and can be used in lieu of dispersion staining. Dispersion staining is performed on the same platform as the phase-polar analysis with the analyzer and compensator removed. One polarizing element remains to define the direction of the light so that the different indices of refraction of the fibers may be separately determined. Dispersion microscopy is a dark-field technique when used for asbestos. Particles are imaged with scattered light. Light which is unscattered is blocked from reaching the eye either by the back field image mask in a McCrone objective or a back field image mask in the phase condenser. The most convenient method is to use the rotating phase condenser to move an oversized phase ring into place. The ideal size for this ring is for the central disk to be just larger than the objective entry aperture as viewed in the back focal plane. The larger the disk, the less scattered light reaches the eye. This will have the effect of diminishing the intensity of dispersion color and will shift the actual color seen. The colors seen vary even on microscopes from the same manufacturer. This is due to the different bands of wavelength exclusion by different mask sizes. The mask may either reside in the condenser or in the objective back focal plane. It is imperative that the analyst determine by experimentation with asbestos standards what the appropriate colors should be for each asbestos type. The colors depend also on the temperature of the preparation and the exact chemistry of the asbestos. Therefore, some slight differences from the standards should be allowed. This is not a serious problem for commercial asbestos uses. This technique is used for identification of the indices of refraction for fibers by recognition of color. There is no direct numerical readout of the index of refraction. Correlation of color to actual index of refraction is possible by referral to published conversion tables. This is not necessary for the analysis of asbestos. Recognition of appropriate colors along with the proper morphology are deemed sufficient to identify the commercial asbestos minerals. Other techniques including SEM, TEM, and XRD may be required to provide additional information in order to identify other types of asbestos.

Make a preparation in the suspected matching high dispersion oil, e.g., $n = 1.550$ for chrysotile. Perform the preliminary tests to determine whether the fibers are birefringent or not. Take note of the morphological character. Wavy fibers are indicative of chrysotile while long, straight, thin, frayed fibers are indicative of amphibole asbestos. This can aid in the selection of the appropriate matching oil. The microscope is set up and the polarization direction is noted as in Section 4.4. Align a fiber with the polarization direction. Note the color. This is the color parallel to the polarizer. Then rotate the fiber rotating the stage 90 deg. so that the polarization direction is across the fiber. This is the perpendicular position. Again note the color. Both colors must be consistent with standard asbestos minerals in the correct direction for a positive identification of asbestos. If only one of the colors is correct while the other is not, the identification is not positive. If the colors in both directions are bluish-white, the analyst has chosen a matching index oil which is higher than the correct matching oil, e.g. the analyst has used $n = 1.620$ where chrysotile is present. The next lower oil (Section 3.5.) should be used to prepare another specimen. If the color in both directions is yellow-white to straw-yellow-white, this indicates that the index of the oil is lower than the index of the fiber, e.g. the preparation is in $n = 1.550$ while anthophyllite is present. Select the next higher oil (Section 3.5.) and prepare another slide. Continue in this fashion until a positive identification of all asbestos species present has been made or all possible asbestos species have been ruled out by negative results in this test. Certain plant fibers can have similar dispersion colors as asbestos. Take care to note and evaluate the morphology of the fibers or remove the plant fibers in pre-preparation. Coating material on the fibers such as carbonate or vinyl may destroy the dispersion color. Usually, there will be some outcropping of fiber which will show the colors sufficient for identification. When this is not the case, treat the sample as described in Section 3.3. and then perform dispersion staining. Some samples will yield to Becke line analysis if they are coated or electron microscopy can be used for identification.

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- **Part Number:** 1926
 - **Part Title:** Safety and Health Regulations for Construction
 - **Subpart:** Z
 - **Subpart Title:** Toxic and Hazardous Substances
 - **Standard Number:** 1926.1101
 - **Title:** Asbestos
 - **Appendix:** A , B , C , D , E , F , G , H , I , J , K
-

1926.1101(a)

Scope and application. This section regulates asbestos exposure in all work as defined in 29 CFR 1910.12(b), including but not limited to the following:

1926.1101(a)(1)

Demolition or salvage of structures where asbestos is present;

1926.1101(a)(2)

Removal or encapsulation of materials containing asbestos;

1926.1101(a)(3)

Construction, alteration, repair, maintenance, or renovation of structures, substrates, or portions thereof, that contain asbestos;

1926.1101(a)(4)

Installation of products containing asbestos;

1926.1101(a)(5)

Asbestos spill/emergency cleanup; and

1926.1101(a)(6)

Transportation, disposal, storage, containment of and housekeeping activities involving asbestos or products containing asbestos, on the site or location at which construction activities are performed.

1926.1101(a)(7)

Coverage under this standard shall be based on the nature of the work operation involving asbestos exposure.

1926.1101(a)(8)

This section does not apply to asbestos-containing asphalt roof coatings, cements and mastics.

1926.1101(b)

Definitions.

Aggressive method means removal or disturbance of building material by sanding, abrading, grinding or other method that breaks, crumbles, or disintegrates intact ACM.

Amended water means water to which surfactant (wetting agent) has been added to increase the ability of the liquid to penetrate ACM.

Asbestos includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that has been chemically treated and/or altered. For purposes of this standard, "asbestos" includes PACM, as defined below.

Asbestos-containing material (ACM), means any material containing more than one percent asbestos.

Assistant Secretary means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

Authorized person means any person authorized by the employer and required by work duties to be present in regulated areas.

Building/facility owner is the legal entity, including a lessee, which exercises control over management and record keeping functions relating to a building and/or facility in which activities covered by this standard take place.

Certified Industrial Hygienist (CIH) means one certified in the practice of industrial hygiene by the American Board of Industrial Hygiene.

Class I asbestos work means activities involving the removal of TSI and surfacing ACM and PACM.

Class II asbestos work means activities involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastics.

Class III asbestos work means repair and maintenance operations, where "ACM", including TSI and surfacing ACM and PACM, is likely to be disturbed.

Class IV asbestos work means maintenance and custodial activities during which employees contact but do not disturb ACM or PACM and activities to clean up dust, waste and debris resulting from Class I, II, and III activities.

Clean room means an uncontaminated room having facilities for the storage of employees' street clothing and uncontaminated materials and equipment.

Closely resemble means that the major workplace conditions which have contributed to the levels of historic asbestos exposure, are no more protective than conditions of the current workplace.

Competent person means, in addition to the definition in 29 CFR 1926.32 (f), one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f): in addition, for Class I and Class II work who is specially trained in a training course which meets the criteria of EPA's Model Accreditation Plan (40 CFR 763) for supervisor, or its equivalent and, for Class III and Class IV work, who is trained in a manner consistent with EPA requirements for training of local education agency maintenance and custodial staff as set forth at 40 CFR 763.92 (a)(2).

Critical barrier means one or more layers of plastic sealed over all openings into a work area or any other similarly placed physical barrier sufficient to prevent airborne asbestos in a work area from migrating to an adjacent area.

Decontamination area means an enclosed area adjacent and connected to the regulated area and consisting of an equipment room, shower area, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.

Demolition means the wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.

Director means the Director, National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designee.

Disturbance means activities that disrupt the matrix of ACM or PACM, crumble or pulverize ACM or PACM, or generate visible debris from ACM or PACM. Disturbance includes cutting away small amounts of ACM and PACM, no greater than the amount which can be contained in one standard sized glove bag or waste bag in order to access a building component. In no event shall the amount of ACM or PACM so disturbed exceed that which can be contained in one glove bag or waste bag which shall not exceed 60 inches in length and width.

Employee exposure means that exposure to airborne asbestos that would occur if the employee were not using respiratory protective equipment.

Equipment room (change room) means a contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

Fiber means a particulate form of asbestos, 5 micrometers or longer, with a length-to-diameter ratio of at least 3 to 1.

Glovebag means not more than a 60 x 60 inch impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which material and tools may be handled.

High-efficiency particulate air (HEPA) filter means a filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.

Homogeneous area means an area of surfacing material or thermal system insulation that is uniform in color and texture.

Industrial hygienist means a professional qualified by education, training, and experience to anticipate, recognize, evaluate and develop controls for occupational health hazards.

Intact means that the ACM has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix.

Modification for purposes of paragraph (g)(6)(ii), means a changed or altered procedure, material or component of a control system, which replaces a procedure, material or component of a required system. Omitting a procedure or component, or reducing or diminishing the stringency or strength of a material or component of the control system is not a "modification" for purposes of paragraph (g)(6) of this section.

Negative Initial Exposure Assessment means a demonstration by the employer, which complies with the criteria in paragraph (f)(2)(iii) of this section, that employee exposure during an operation is expected to be consistently below the PELs.

PACM means "presumed asbestos containing material".

Presumed Asbestos Containing Material means thermal system insulation and surfacing material found in buildings constructed no later than 1980. The designation of a material as "PACM" may be rebutted pursuant to paragraph (k)(5) of this section.

Project Designer means a person who has successfully completed the training requirements for an abatement project designer established by 40 U.S.C. Sec. 763.90(g).

Regulated area means: an area established by the employer to demarcate areas where Class I, II, and III asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work accumulate; and a work area within which airborne concentrations of asbestos, exceed or there is a reasonable

possibility they may exceed the permissible exposure limit. Requirements for regulated areas are set out in paragraph (e) of this section.

Removal means all operations where ACM and/or PACM is taken out or stripped from structures or substrates, and includes demolition operations.

Renovation means the modifying of any existing structure, or portion thereof.

Repair means overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates, including encapsulation or other repair of ACM or PACM attached to structures or substrates.

Surfacing material means material that is sprayed, troweled-on or otherwise applied to surfaces (such as acoustical plaster on ceilings and fireproofing materials on structural members, or other materials on surfaces for acoustical, fireproofing, and other purposes).

Surfacing ACM means surfacing material which contains more than 1% asbestos.

Thermal system insulation (TSI) means ACM applied to pipes, fittings, boilers, breeching, tanks, ducts or other structural components to prevent heat loss or gain.

Thermal system insulation ACM is thermal system insulation which contains more than 1% asbestos.

[1926.1101\(c\)](#)

Permissible exposure limits (PELS).

[1926.1101\(c\)\(1\)](#)

Time-weighted average limit (TWA). The employer shall ensure that no employee is exposed to an airborne concentration of asbestos in excess of 0.1 fiber per cubic centimeter of air as an eight (8) hour time-weighted average (TWA), as determined by the method prescribed in Appendix A to this section, or by an equivalent method.

1926.1101(c)(2)

Excursion limit. The employer shall ensure that no employee is exposed to an airborne concentration of asbestos in excess of 1.0 fiber per cubic centimeter of air (1 f/cc) as averaged over a sampling period of thirty (30) minutes, as determined by the method prescribed in Appendix A to this section, or by an equivalent method.

1926.1101(d)

Multi-employer worksites.

1926.1101(d)(1)

On multi-employer worksites, an employer performing work requiring the establishment of a regulated area shall inform other employers on the site of the nature of the employer's work with asbestos and/or PACM, of the existence of and requirements pertaining to regulated areas, and the measures taken to ensure that employees of such other employers are not exposed to asbestos.

1926.1101(d)(2)

Asbestos hazards at a multi-employer work site shall be abated by the contractor who created or controls the source of asbestos contamination. For example, if there is a significant breach of an enclosure containing Class I

work, the employer responsible for erecting the enclosure shall repair the breach immediately.

1926.1101(d)(3)

In addition, all employers of employees exposed to asbestos hazards shall comply with applicable protective provisions to protect their employees. For example, if employees working immediately adjacent to a Class I asbestos job are exposed to asbestos due to the inadequate containment of such job, their employer shall either remove the employees from the area until the enclosure breach is repaired; or perform an initial exposure assessment pursuant to (f) of this section.

1926.1101(d)(4)

All employers of employees working adjacent to regulated areas established by another employer on a multi-employer work-site, shall take steps on a daily basis to ascertain the integrity of the enclosure and/or the effectiveness of the control method relied on by the primary asbestos contractor to assure that asbestos fibers do not migrate to such adjacent areas.

1926.1101(d)(5)

All general contractors on a construction project which includes work covered by this standard shall be deemed to exercise general supervisory authority over the work covered by this standard, even though the general contractor is not qualified to serve as the asbestos "competent person" as defined by paragraph (b) of this section. As supervisor of the entire project, the general contractor shall ascertain whether the asbestos contractor is in compliance with this standard, and shall require such contractor to come into compliance with this standard when necessary.

[1926.1101\(e\)](#)

Regulated areas.

[1926.1101\(e\)\(1\)](#)

All Class I, II and III asbestos work shall be conducted within regulated areas. All other operations covered by this standard shall be conducted within a regulated area where airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed a PEL. Regulated areas shall comply with the requirements of paragraphs (2), (3), (4) and (5) of this section.

1926.1101(e)(2)

Demarcation. The regulated area shall be demarcated in any manner that minimizes the number of persons within the area and protects persons outside the area from exposure to airborne asbestos. Where critical barriers or negative pressure enclosures are used, they may demarcate the regulated area. Signs shall be provided and displayed pursuant to the requirements of paragraph (k)(7) of this section.

1926.1101(e)(3)

Access. Access to regulated areas shall be limited to authorized persons and to persons authorized by the Act or regulations issued pursuant thereto.

1926.1101(e)(4)

Respirators. All persons entering a regulated area where employees are required pursuant to paragraph (h)(1) of this section to wear respirators shall be supplied with a respirator selected in accordance with paragraph (h)(2) of

this section.

1926.1101(e)(5)

Prohibited activities. The employer shall ensure that employees do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in the regulated area.

1926.1101(e)(6)

Competent Persons. The employer shall ensure that all asbestos work performed within regulated areas is supervised by a competent person, as defined in paragraph (b) of this section. The duties of the competent person are set out in paragraph (o) of this section.

[1926.1101\(f\)](#)

Exposure assessments and monitoring.

[1926.1101\(f\)\(1\)](#)

General monitoring criteria.

1926.1101(f)(1)(i)

Each employer who has a workplace or work operation where exposure monitoring is required under this section shall perform monitoring to determine accurately the airborne concentrations of asbestos to which employees may be exposed.

1926.1101(f)(1)(ii)

Determinations of employee exposure shall be made from breathing zone air samples that are representative of the 8-hour TWA and 30-minute short-term exposures of each employee.

1926.1101(f)(1)(iii)

Representative 8-hour TWA employee exposure shall be determined on the basis of one or more samples representing full-shift exposure for employees in each work area. Representative 30-minute short-term employee exposures shall be determined on the basis of one or more samples representing 30 minute exposures associated with operations that are most likely to produce exposures above the excursion limit for employees in each work area.

[1926.1101\(f\)\(2\)](#)

Initial Exposure Assessment.

1926.1101(f)(2)(i)

Each employer who has a workplace or work operation covered by this standard shall ensure that a "competent person" conducts an exposure assessment immediately before or at the initiation of the operation to ascertain expected exposures during that operation or workplace. The assessment must be completed in time to comply with requirements which are triggered by exposure data or the lack of a "negative exposure assessment," and to provide information necessary to assure that all control systems planned are appropriate for that operation and will work properly.

1926.1101(f)(2)(ii)

Basis of Initial Exposure Assessment: Unless a negative exposure assessment has been made pursuant to paragraph (f)(2)(iii) of this section, the initial exposure assessment shall, if feasible, be based on monitoring conducted pursuant to paragraph (f)(1)(iii) of this section. The assessment shall take into consideration both the monitoring results and all observations, information or calculations which indicate employee exposure to asbestos, including any previous monitoring conducted in the workplace, or of the operations of the employer which indicate the levels of airborne asbestos likely to be encountered on the job. For Class I asbestos work, until the employer conducts exposure monitoring and documents that employees on that job will not be exposed in excess of the PELs, or otherwise makes a negative exposure assessment pursuant to paragraph (f)(2)(iii) of this section, the employer shall presume that employees are exposed in excess of the TWA and excursion limit.

1926.1101(f)(2)(iii)

Negative Exposure Assessment: For any one specific asbestos job which will be performed by employees who have been trained in compliance with the standard, the employer may demonstrate that employee exposures will be below the PELs by data which conform to the following criteria;

1926.1101(f)(2)(iii)(A)

Objective data demonstrating that the product or material containing asbestos minerals or the activity involving such product or material cannot release airborne fibers in concentrations exceeding the TWA and excursion limit under those work conditions having the greatest potential for releasing asbestos; or

1926.1101(f)(2)(iii)(B)

Where the employer has monitored prior asbestos jobs for the PEL and the excursion limit within 12 months of the current or projected job, the monitoring and analysis were performed in compliance with the asbestos standard in effect; and the data were obtained during work operations conducted under workplace conditions "closely resembling" the processes, type of material, control methods, work practices, and environmental conditions used and prevailing in the employer's current operations, the operations were conducted by employees whose training and experience are no more extensive than that of employees performing the current job, and these data show that under the conditions prevailing and which will prevail in the current workplace there is a high degree of certainty that employee exposures will not exceed the TWA and excursion limit; or

1926.1101(f)(2)(iii)(C)

The results of initial exposure monitoring of the current job made from breathing zone air samples that are representative of the 8-hour TWA and 30-minute short-term exposures of each employee covering operations which are most likely during the performance of the entire asbestos job to result in exposures over the PELs.

1926.1101(f)(3)

Periodic monitoring.

1926.1101(f)(3)(i)

Class I and II operations. The employer shall conduct daily monitoring that is representative of the exposure of each employee who is assigned to work within a regulated area who is performing Class I or II work, unless the employer pursuant to (f)(2)(iii) of this section, has made a negative exposure assessment for the entire operation.

1926.1101(f)(3)(ii)

All operations under the standard other than Class I and II operations. The employer shall conduct periodic monitoring of all work where exposures are expected to exceed a PEL, at intervals sufficient to document the

validity of the exposure prediction.

1926.1101(f)(3)(iii)

Exception: When all employees required to be monitored daily are equipped with supplied-air respirators operated in the pressure demand mode, or other positive pressure mode respirator, the employer may dispense with the daily monitoring required by this paragraph. However, employees performing Class I work using a control method which is not listed in paragraph (g)(4)(i), (ii), or (iii) of this section or using a modification of a listed control method, shall continue to be monitored daily even if they are equipped with supplied-air respirators.

1926.1101(f)(4)

Termination of monitoring.

1926.1101(f)(4)(i)

If the periodic monitoring required by paragraph (f)(3) of this section reveals that employee exposures, as indicated by statistically reliable measurements, are below the permissible exposure limit and excursion limit the employer may discontinue monitoring for those employees whose exposures are represented by such monitoring.

1926.1101(f)(4)(ii)

Additional monitoring. Notwithstanding the provisions of paragraph (f)(2) and (3), and (f)(4) of this section, the employer shall institute the exposure monitoring required under paragraph (f)(3) of this section whenever there has been a change in process, control equipment, personnel or work practices that may result in new or additional exposures above the permissible exposure limit and/or excursion limit or when the employer has any reason to suspect that a change may result in new or additional exposures above the permissible exposure limit and/or excursion limit. Such additional monitoring is required regardless of whether a "negative exposure assessment" was previously produced for a specific job.

[1926.1101\(f\)\(5\)](#)

Employee notification of monitoring results. The employer must, as soon as possible but no later than 5 working days after the receipt of the results of any monitoring performed under this section, notify each affected employee of these results either individually in writing or by posting the results in an appropriate location that is accessible to employees.

1926.1101(f)(5)(i)

The employer shall notify affected employees of the monitoring results that represent that employee's exposure as soon as possible following receipt of monitoring results.

1926.1101(f)(5)(ii)

The employer shall notify affected employees of the results of monitoring representing the employee's exposure in writing either individually or by posting at a centrally located place that is accessible to affected employees.

[1926.1101\(f\)\(6\)](#)

Observation of monitoring.

1926.1101(f)(6)(i)

The employer shall provide affected employees and their designated representatives an opportunity to observe

any monitoring of employee exposure to asbestos conducted in accordance with this section.

1926.1101(f)(6)(ii)

When observation of the monitoring of employee exposure to asbestos requires entry into an area where the use of protective clothing or equipment is required, the observer shall be provided with and be required to use such clothing and equipment and shall comply with all other applicable safety and health procedures.

[1926.1101\(g\)](#)

Methods of compliance.

[1926.1101\(g\)\(1\)](#)

Engineering controls and work practices for all operations covered by this section. The employer shall use the following engineering controls and work practices in all operations covered by this section, regardless of the levels of exposure:

1926.1101(g)(1)(i)

Vacuum cleaners equipped with HEPA filters to collect all debris and dust containing ACM and PACM, except as provided in paragraph (g)(8)(ii) of this section in the case of roofing material.

[1926.1101\(g\)\(1\)\(ii\)](#)

Wet methods, or wetting agents, to control employee exposures during asbestos handling, mixing, removal, cutting, application, and cleanup, except where employers demonstrate that the use of wet methods is infeasible due to for example, the creation of electrical hazards, equipment malfunction, and, in roofing, except as provide in paragraph (g)(8)(ii) of this section; and

[1926.1101\(g\)\(1\)\(iii\)](#)

Prompt clean-up and disposal of wastes and debris contaminated with asbestos in leak-tight containers except in roofing operations, where the procedures specified in paragraph (g)(8)(ii) of this section apply.

1926.1101(g)(2)

In addition to the requirements of paragraph (g)(1) of this section, the employer shall use the following control methods to achieve compliance with the TWA permissible exposure limit and excursion limit prescribed by paragraph (c) of this section;

1926.1101(g)(2)(i)

Local exhaust ventilation equipped with HEPA filter dust collection systems;

[1926.1101\(g\)\(2\)\(ii\)](#)

Enclosure or isolation of processes producing asbestos dust;

1926.1101(g)(2)(iii)

Ventilation of the regulated area to move contaminated air away from the breathing zone of employees and toward a filtration or collection device equipped with a HEPA filter;

1926.1101(g)(2)(iv)

Use of other work practices and engineering controls that the Assistant Secretary can show to be feasible.

1926.1101(g)(2)(v)

Wherever the feasible engineering and work practice controls described above are not sufficient to reduce employee exposure to or below the permissible exposure limit and/or excursion limit prescribed in paragraph (c) of this section, the employer shall use them to reduce employee exposure to the lowest levels attainable by these controls and shall supplement them by the use of respiratory protection that complies with the requirements of paragraph (h) of this section.

[1926.1101\(g\)\(3\)](#)

Prohibitions. The following work practices and engineering controls shall not be used for work related to asbestos or for work which disturbs ACM or PACM, regardless of measured levels of asbestos exposure or the results of initial exposure assessments:

[1926.1101\(g\)\(3\)\(i\)](#)

High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air.

[1926.1101\(g\)\(3\)\(ii\)](#)

Compressed air used to remove asbestos, or materials containing asbestos, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.

[1926.1101\(g\)\(3\)\(iii\)](#)

Dry sweeping, shoveling or other dry clean-up of dust and debris containing ACM and PACM.

[1926.1101\(g\)\(3\)\(iv\)](#)

Employee rotation as a means of reducing employee exposure to asbestos.

[1926.1101\(g\)\(4\)](#)

Class I Requirements. In addition to the provisions of paragraphs (g)(1) and (2) of this section, the following engineering controls and work practices and procedures shall be used.

[1926.1101\(g\)\(4\)\(i\)](#)

All Class I work, including the installation and operation of the control system shall be supervised by a competent person as defined in paragraph (b) of this section;

[1926.1101\(g\)\(4\)\(ii\)](#)

For all Class I jobs involving the removal of more than 25 linear or 10 square feet of thermal system insulation or surfacing material; for all other Class I jobs, where the employer cannot produce a negative exposure assessment pursuant to paragraph (f)(2)(iii) of this section, or where employees are working in areas adjacent to the regulated area, while the Class I work is being performed, the employer shall use one of the following methods to

ensure that airborne asbestos does not migrate from the regulated area:

1926.1101(g)(4)(ii)(A)

Critical barriers shall be placed over all the openings to the regulated area, except where activities are performed outdoors; or

1926.1101(g)(4)(ii)(B)

The employer shall use another barrier or isolation method which prevents the migration of airborne asbestos from the regulated area, as verified by perimeter area surveillance during each work shift at each boundary of the regulated area, showing no visible asbestos dust; and perimeter area monitoring showing that clearance levels contained in 40 CFR Part 763, Subpt. E, of the EPA Asbestos in Schools Rule are met, or that perimeter area levels, measured by Phase Contrast Microscopy (PCM) are no more than background levels representing the same area before the asbestos work began. The results of such monitoring shall be made known to the employer no later than 24 hours from the end of the work shift represented by such monitoring. Exception: For work completed outdoors where employees are not working in areas adjacent to the regulated areas, this paragraph (g)(4)(ii) is satisfied when the specific control methods in paragraph (g)(5) of this section are used.

1926.1101(g)(4)(iii)

For all Class I jobs, HVAC systems shall be isolated in the regulated area by sealing with a double layer of 6 mil plastic or the equivalent;

1926.1101(g)(4)(iv)

For all Class I jobs, impermeable dropcloths shall be placed on surfaces beneath all removal activity;

1926.1101(g)(4)(v)

For all Class I jobs, all objects within the regulated area shall be covered with impermeable dropcloths or plastic sheeting which is secured by duct tape or an equivalent.

1926.1101(g)(4)(vi)

For all Class I jobs where the employer cannot produce a negative exposure assessment, or where exposure monitoring shows that a PEL is exceeded, the employer shall ventilate the regulated area to move contaminated air away from the breathing zone of employees toward a HEPA filtration or collection device.

[1926.1101\(g\)\(5\)](#)

Specific control methods for Class I work. In addition, Class I asbestos work shall be performed using one or more of the following control methods pursuant to the limitations stated below:

1926.1101(g)(5)(i)

Negative Pressure Enclosure (NPE) systems: NPE systems may be used where the configuration of the work area does not make the erection of the enclosure infeasible, with the following specifications and work practices.

1926.1101(g)(5)(i)(A)

Specifications:

1926.1101(g)(5)(i)(A)(1)

The negative pressure enclosure (NPE) may be of any configuration,

1926.1101(g)(5)(i)(A)(2)

At least 4 air changes per hour shall be maintained in the NPE,

1926.1101(g)(5)(i)(A)(3)

A minimum of -0.02 column inches of water pressure differential, relative to outside pressure, shall be maintained within the NPE as evidenced by manometric measurements,

1926.1101(g)(5)(i)(A)(4)

The NPE shall be kept under negative pressure throughout the period of its use, and

1926.1101(g)(5)(i)(A)(5)

Air movement shall be directed away from employees performing asbestos work within the enclosure, and toward a HEPA filtration or a collection device.

1926.1101(g)(5)(i)(B)

Work Practices:

1926.1101(g)(5)(i)(B)(1)

Before beginning work within the enclosure and at the beginning of each shift, the NPE shall be inspected for breaches and smoke-tested for leaks, and any leaks sealed.

1926.1101(g)(5)(i)(B)(2)

Electrical circuits in the enclosure shall be deactivated, unless equipped with ground-fault circuit interrupters.

1926.1101(g)(5)(ii)

Glove bag systems may be used to remove PACM and/or ACM from straight runs of piping and elbows and other connections with the following specifications and work practices:

1926.1101(g)(5)(ii)(A)

Specifications:

1926.1101(g)(5)(ii)(A)(1)

Glovebags shall be made of 6 mil thick plastic and shall be seamless at the bottom.

1926.1101(g)(5)(ii)(A)(2)

Glovebags used on elbows and other connections must be designed for that purpose and used without modifications.

1926.1101(g)(5)(ii)(B)

Work Practices:

1926.1101(g)(5)(ii)(B)(1)

Each glovebag shall be installed so that it completely covers the circumference of pipe or other structure where the work is to be done.

1926.1101(g)(5)(ii)(B)(2)

Glovebags shall be smoke-tested for leaks and any leaks sealed prior to use.

1926.1101(g)(5)(ii)(B)(3)

Glovebags may be used only once and may not be moved.

[1926.1101\(g\)\(5\)\(ii\)\(B\)\(4\)](#)

Glovebags shall not be used on surfaces whose temperature exceeds 150 deg. F.

1926.1101(g)(5)(ii)(B)(5)

Prior to disposal, glovebags shall be collapsed by removing air within them using a HEPA vacuum.

1926.1101(g)(5)(ii)(B)(6)

Before beginning the operation, loose and friable material adjacent to the glovebag/box operation shall be wrapped and sealed in two layers of six mil plastic or otherwise rendered intact,

1926.1101(g)(5)(ii)(B)(7)

Where system uses attached waste bag, such bag shall be connected to collection bag using hose or other material which shall withstand pressure of ACM waste and water without losing its integrity:

1926.1101(g)(5)(ii)(B)(8)

Sliding valve or other device shall separate waste bag from hose to ensure no exposure when waste bag is disconnected:

1926.1101(g)(5)(ii)(B)(9)

At least two persons shall perform Class I glovebag removal operations.

1926.1101(g)(5)(iii)

Negative Pressure Glove Bag Systems. Negative pressure glove bag systems may be used to remove ACM or PACM from piping.

1926.1101(g)(5)(iii)(A)

Specifications: In addition to specifications for glove bag systems above, negative pressure glove bag systems shall attach HEPA vacuum systems or other devices to bag to prevent collapse during removal.

1926.1101(g)(5)(iii)(B)

Work Practices:

1926.1101(g)(5)(iii)(B)(1)

The employer shall comply with the work practices for glove bag systems in paragraph (g)(5)(ii)(B)(4) of this section.

1926.1101(g)(5)(iii)(B)(2)

The HEPA vacuum cleaner or other device used to prevent collapse of bag during removal shall run continually during the operation until it is completed at which time the bag shall be collapsed prior to removal of the bag from the pipe.

1926.1101(g)(5)(iii)(B)(3)

Where a separate waste bag is used along with a collection bag and discarded after one use, the collection bag may be reused if rinsed clean with amended water before reuse.

[1926.1101\(g\)\(5\)\(iv\)](#)

Negative Pressure Glove Box Systems: Negative pressure glove boxes may be used to remove ACM or PACM from pipe runs with the following specifications and work practices.

1926.1101(g)(5)(iv)(A)

Specifications:

1926.1101(g)(5)(iv)(A)(1)

Glove boxes shall be constructed with rigid sides and made from metal or other material which can withstand the weight of the ACM and PACM and water used during removal:

1926.1101(g)(5)(iv)(A)(2)

A negative pressure generator shall be used to create negative pressure in the system:

1926.1101(g)(5)(iv)(A)(3)

An air filtration unit shall be attached to the box:

1926.1101(g)(5)(iv)(A)(4)

The box shall be fitted with gloved apertures:

1926.1101(g)(5)(iv)(A)(5)

An aperture at the base of the box shall serve as a bagging outlet for waste ACM and water:

1926.1101(g)(5)(iv)(A)(6)

A back-up generator shall be present on site:

1926.1101(g)(5)(iv)(A)(7)

Waste bags shall consist of 6 mil thick plastic double-bagged before they are filled or plastic thicker than 6 mil.

1926.1101(g)(5)(iv)(B)

Work practices:

1926.1101(g)(5)(iv)(B)(1)

At least two persons shall perform the removal:

1926.1101(g)(5)(iv)(B)(2)

The box shall be smoke-tested for leaks and any leaks sealed prior to each use:

1926.1101(g)(5)(iv)(B)(3)

Loose or damaged ACM adjacent to the box shall be wrapped and sealed in two layers of 6 mil plastic prior to the job, or otherwise made intact prior to the job.

1926.1101(g)(5)(iv)(B)(4)

A HEPA filtration system shall be used to maintain pressure barrier in box.

1926.1101(g)(5)(v)

Water Spray Process System. A water spray process system may be used for removal of ACM and PACM from cold line piping if, employees carrying out such process have completed a 40-hour separate training course in its use, in addition to training required for employees performing Class I work. The system shall meet the following specifications and shall be performed by employees using the following work practices.

1926.1101(g)(5)(v)(A)

Specifications:

1926.1101(g)(5)(v)(A)(1)

Piping shall be surrounded on 3 sides by rigid framing,

1926.1101(g)(5)(v)(A)(2)

A 360 degree water spray, delivered through nozzles supplied by a high pressure separate water line, shall be formed around the piping.

1926.1101(g)(5)(v)(A)(3)

The spray shall collide to form a fine aerosol which provides a liquid barrier between workers and the ACM and PACM.

1926.1101(g)(5)(v)(B)

Work Practices:

1926.1101(g)(5)(v)(B)(1)

The system shall be run for at least 10 minutes before removal begins.

1926.1101(g)(5)(v)(B)(2)

All removal shall take place within the water barrier.

1926.1101(g)(5)(v)(B)(3)

The system shall be operated by at least three persons, one of whom shall not perform removal, but shall check equipment, and ensure proper operation of the system.

1926.1101(g)(5)(v)(B)(4)

After removal, the ACM and PACM shall be bagged while still inside the water barrier.

1926.1101(g)(5)(vi)

A small walk-in enclosure which accommodates no more than two persons (mini-enclosure) may be used if the disturbance or removal can be completely contained by the enclosure with the following specifications and work practices.

1926.1101(g)(5)(vi)(A)

Specifications:

1926.1101(g)(5)(vi)(A)(1)

The fabricated or job-made enclosure shall be constructed of 6 mil plastic or equivalent:

1926.1101(g)(5)(vi)(A)(2)

The enclosure shall be placed under negative pressure by means of a HEPA filtered vacuum or similar ventilation unit:

1926.1101(g)(5)(vi)(B)

Work practices:

1926.1101(g)(5)(vi)(B)(1)

Before use, the mini-enclosure shall be inspected for leaks and smoke-tested to detect breaches, and breaches sealed.

1926.1101(g)(5)(vi)(B)(2)

Before reuse, the interior shall be completely washed with amended water and HEPA-vacuumed.

1926.1101(g)(5)(vi)(B)(3)

During use, air movement shall be directed away from the employee's breathing zone within the mini-enclosure.

[1926.1101\(g\)\(6\)](#)

Alternative control methods for Class I work. Class I work may be performed using a control method which is not referenced in paragraph (g)(5) of this section, or which modifies a control method referenced in paragraph (g)(5) of this section, if the following provisions are complied with:

1926.1101(g)(6)(i)

The control method shall enclose, contain or isolate the processes or source of airborne asbestos dust, or otherwise capture or redirect such dust before it enters the breathing zone of employees.

1926.1101(g)(6)(ii)

A certified industrial hygienist or licensed professional engineer who is also qualified as a project designer as defined in paragraph (b) of this section, shall evaluate the work area, the projected work practices and the engineering controls and shall certify in writing that the planned control method is adequate to reduce direct and indirect employee exposure to below the PELs under worst-case conditions of use, and that the planned control method will prevent asbestos contamination outside the regulated area, as measured by clearance sampling which meets the requirements of EPA's Asbestos in Schools rule issued under AHERA, or perimeter monitoring which meets the criteria in paragraph (g)(4)(ii)(B) of this section.

1926.1101(g)(6)(ii)(A)

Where the TSI or surfacing material to be removed is 25 linear or 10 square feet or less, the evaluation required in paragraph (g)(6) of this section may be performed by a "competent person", and may omit consideration of perimeter or clearance monitoring otherwise required.

1926.1101(g)(6)(ii)(B)

The evaluation of employee exposure required in paragraph (g)(6) of this section, shall include and be based on sampling and analytical data representing employee exposure during the use of such method under worst-case conditions and by employees whose training and experience are equivalent to employees who are to perform the current job.

[1926.1101\(g\)\(7\)](#)

Work Practices and Engineering Controls for Class II work.

1926.1101(g)(7)(i)

All Class II work shall be supervised by a competent person as defined in paragraph (b) of this section.

1926.1101(g)(7)(ii)

For all indoor Class II jobs, where the employer has not produced a negative exposure assessment pursuant to paragraph (f)(2)(iii) of this section, or where during the job, changed conditions indicate there may be exposure above the PEL or where the employer does not remove the ACM in a substantially intact state, the employer shall use one of the following methods to ensure that airborne asbestos does not migrate from the regulated area;

1926.1101(g)(7)(ii)(A)

Critical barriers shall be placed over all openings to the regulated area; or,

1926.1101(g)(7)(ii)(B)

The employer shall use another barrier or isolation method which prevents the migration of airborne asbestos from the regulated area, as verified by perimeter area monitoring or clearance monitoring which meets the criteria set out in paragraph (g)(4)(ii)(B) of this section.

1926.1101(g)(7)(ii)(C)

Impermeable dropcloths shall be placed on surfaces beneath all removal activity;

1926.1101(g)(7)(iii)

[Reserved]

1926.1101(g)(7)(iv)

All Class II asbestos work shall be performed using the work practices and requirements set out above in paragraph (g)(1)(i) through (g)(1)(iii) of this section.

[1926.1101\(g\)\(8\)](#)

Additional Controls for Class II work. Class II asbestos work shall also be performed by complying with the work practices and controls designated for each type of asbestos work to be performed, set out in this paragraph. Where more than one control method may be used for a type of asbestos work, the employer may choose one or a combination of designated control methods. Class II work also may be performed using a method allowed for Class I work, except that glove bags and glove boxes are allowed if they fully enclose the Class II material to be removed.

[1926.1101\(g\)\(8\)\(i\)](#)

For removing vinyl and asphalt flooring materials which contain ACM or for which in buildings constructed no later than 1980, the employer has not verified the absence of ACM pursuant to paragraph (g)(8)(i)(I) of this section. The employer shall ensure that employees comply with the following work practices and that employees are trained in these practices pursuant to paragraph (k)(9) of this section:

1926.1101(g)(8)(i)(A)

Flooring or its backing shall not be sanded.

1926.1101(g)(8)(i)(B)

Vacuums equipped with HEPA filter, disposable dust bag, and metal floor tool (no brush) shall be used to clean floors.

1926.1101(g)(8)(i)(C)

Resilient sheeting shall be removed by cutting with wetting of the snip point and wetting during delamination. Rip-up of resilient sheet floor material is prohibited.

[1926.1101\(g\)\(8\)\(i\)\(D\)](#)

All scraping of residual adhesive and/or backing shall be performed using wet methods.

1926.1101(g)(8)(i)(E)

Dry sweeping is prohibited.

1926.1101(g)(8)(i)(F)

Mechanical chipping is prohibited unless performed in a negative pressure enclosure which meets the requirements of paragraph (g)(5)(i) of this section.

1926.1101(g)(8)(i)(G)

Tiles shall be removed intact, unless the employer demonstrates that intact removal is not possible.

1926.1101(g)(8)(i)(H)

When tiles are heated and can be removed intact, wetting may be omitted.

1926.1101(g)(8)(i)(I)

Resilient flooring material including associated mastic and backing shall be assumed to be asbestos-containing unless an industrial hygienist determines that it is asbestos-free using recognized analytical techniques.

[1926.1101\(g\)\(8\)\(ii\)](#)

For removing roofing material which contains ACM the employer shall ensure that the following work practices are followed:

1926.1101(g)(8)(ii)(A)

Roofing material shall be removed in an intact state to the extent feasible.

1926.1101(g)(8)(ii)(B)

Wet methods shall be used to remove roofing materials that are not intact, or that will be rendered not intact during removal, unless such wet methods are not feasible or will create safety hazards.

1926.1101(g)(8)(ii)(C)

Cutting machines shall be continuously misted during use, unless a competent person determines that misting substantially decreases worker safety.

1926.1101(g)(8)(ii)(D)

When removing built-up roofs with asbestos-containing roofing felts and an aggregate surface using a power roof cutter, all dust resulting from the cutting operation shall be collected by a HEPA dust collector, or shall be HEPA vacuumed by vacuuming along the cut line. When removing built-up roofs with asbestos-containing roofing felts and a smooth surface using a power roof cutter, the dust resulting from the cutting operation shall be collected either by a HEPA dust collector or HEPA vacuuming along the cut line, or by gently sweeping and then carefully and completely wiping up the still-wet dust and debris left along the cut line.

1926.1101(g)(8)(ii)(E)

Asbestos-containing material that has been removed from a roof shall not be dropped or thrown to the ground. Unless the material is carried or passed to the ground by hand, it shall be lowered to the ground via covered,

dust-tight chute, crane or hoist:

1926.1101(g)(8)(ii)(E)(1)

Any ACM that is not intact shall be lowered to the ground as soon as is practicable, but in any event no later than the end of the work shift. While the material remains on the roof it shall either be kept wet, placed in an impermeable waste bag, or wrapped in plastic sheeting.

1926.1101(g)(8)(ii)(E)(2)

Intact ACM shall be lowered to the ground as soon as is practicable, but in any event no later than the end of the work shift.

1926.1101(g)(8)(ii)(F)

Upon being lowered, unwrapped material shall be transferred to a closed receptacle in such manner so as to preclude the dispersion of dust.

1926.1101(g)(8)(ii)(G)

Roof level heating and ventilation air intake sources shall be isolated or the ventilation system shall be shut down.

1926.1101(g)(8)(ii)(H)

Notwithstanding any other provision of this section, removal or repair of sections of intact roofing less than 25 square feet in area does not require use of wet methods or HEPA vacuuming as long as manual methods which do not render the material non-intact are used to remove the material and no visible dust is created by the removal method used. In determining whether a job involves less than 25 square feet, the employer shall include all removal and repair work performed on the same roof on the same day.

1926.1101(g)(8)(iii)

When removing cementitious asbestos-containing siding and shingles or transite panels containing ACM on building exteriors (other than roofs, where paragraph (g)(8)(ii) of this section applies) the employer shall ensure that the following work practices are followed:

1926.1101(g)(8)(iii)(A)

Cutting, abrading or breaking siding, shingles, or transite panels, shall be prohibited unless the employer can demonstrate that methods less likely to result in asbestos fiber release cannot be used.

1926.1101(g)(8)(iii)(B)

Each panel or shingle shall be sprayed with amended water prior to removal.

1926.1101(g)(8)(iii)(C)

Unwrapped or unbagged panels or shingles shall be immediately lowered to the ground via covered dust-tight chute, crane or hoist, or placed in an impervious waste bag or wrapped in plastic sheeting and lowered to the ground no later than the end of the work shift.

1926.1101(g)(8)(iii)(D)

Nails shall be cut with flat, sharp instruments.

1926.1101(g)(8)(iv)

When removing gaskets containing ACM, the employer shall ensure that the following work practices are followed:

1926.1101(g)(8)(iv)(A)

If a gasket is visibly deteriorated and unlikely to be removed intact, removal shall be undertaken within a glovebag as described in paragraph (g)(5)(ii) of this section.

1926.1101(g)(8)(iv)(B)

[Reserved]

1926.1101(g)(8)(iv)(C)

The gasket shall be immediately placed in a disposal container.

1926.1101(g)(8)(iv)(D)

Any scraping to remove residue must be performed wet.

1926.1101(g)(8)(v)

When performing any other Class II removal of asbestos containing material for which specific controls have not been listed in paragraph (g)(8)(iv)(A) through (D) of this section, the employer shall ensure that the following work practices are complied with.

1926.1101(g)(8)(v)(A)

The material shall be thoroughly wetted with amended water prior to and during its removal.

1926.1101(g)(8)(v)(B)

The material shall be removed in an intact state unless the employer demonstrates that intact removal is not possible.

1926.1101(g)(8)(v)(C)

Cutting, abrading or breaking the material shall be prohibited unless the employer can demonstrate that methods less likely to result in asbestos fiber release are not feasible.

1926.1101(g)(8)(v)(D)

Asbestos-containing material removed, shall be immediately bagged or wrapped, or kept wetted until transferred to a closed receptacle, no later than the end of the work shift.

[1926.1101\(g\)\(8\)\(vi\)](#)

Alternative Work Practices and Controls. Instead of the work practices and controls listed in paragraph (g)(8)(i) through (v) of this section, the employer may use different or modified engineering and work practice controls if

the following provisions are complied with.

1926.1101(g)(8)(vi)(A)

The employer shall demonstrate by data representing employee exposure during the use of such method under conditions which closely resemble the conditions under which the method is to be used, that employee exposure will not exceed the PELs under any anticipated circumstances.

1926.1101(g)(8)(vi)(B)

A competent person shall evaluate the work area, the projected work practices and the engineering controls, and shall certify in writing, that the different or modified controls are adequate to reduce direct and indirect employee exposure to below the PELs under all expected conditions of use and that the method meets the requirements of this standard. The evaluation shall include and be based on data representing employee exposure during the use of such method under conditions which closely resemble the conditions under which the method is to be used for the current job, and by employees whose training and experience are equivalent to employees who are to perform the current job.

1926.1101(g)(9)

Work Practices and Engineering Controls for Class III asbestos work. Class III asbestos work shall be conducted using engineering and work practice controls which minimize the exposure to employees performing the asbestos work and to bystander employees.

1926.1101(g)(9)(i)

The work shall be performed using wet methods.

1926.1101(g)(9)(ii)

To the extent feasible, the work shall be performed using local exhaust ventilation.

1926.1101(g)(9)(iii)

Where the disturbance involves drilling, cutting, abrading, sanding, chipping, breaking, or sawing of thermal system insulation or surfacing material, the employer shall use impermeable dropcloths, and shall isolate the operation using mini-enclosures or glove bag systems pursuant to paragraph (g)(5) of this section or another isolation method.

1926.1101(g)(9)(iv)

Where the employer does not produce a "negative exposure assessment" for a job, or where monitoring results show the PEL has been exceeded, the employer shall contain the area using impermeable dropcloths and plastic barriers or their equivalent, or shall isolate the operation using a control system listed in and in compliance with paragraph (g)(5) of this section.

1926.1101(g)(9)(v)

Employees performing Class III jobs, which involve the disturbance of thermal system insulation or surfacing material, or where the employer does not produce a "negative exposure assessment" or where monitoring results show a PEL has been exceeded, shall wear respirators which are selected, used and fitted pursuant to provisions of paragraph (h) of this section.

1926.1101(g)(10)

Class IV asbestos work. Class IV asbestos jobs shall be conducted by employees trained pursuant to the asbestos awareness training program set out in paragraph (k)(9) of this section. In addition, all Class IV jobs shall be conducted in conformity with the requirements set out in paragraph (g)(1) of this section, mandating wet methods, HEPA vacuums, and prompt clean up of debris containing ACM or PACM.

1926.1101(g)(10)(i)

Employees cleaning up debris and waste in a regulated area where respirators are required shall wear respirators which are selected, used and fitted pursuant to provisions of paragraph (h) of this section.

1926.1101(g)(10)(ii)

Employers of employees who clean up waste and debris in, and employers in control of, areas where friable thermal system insulation or surfacing material is accessible, shall assume that such waste and debris contain asbestos.

1926.1101(g)(11)

Alternative methods of compliance for installation, removal, repair, and maintenance of certain roofing and pipeline coating materials. Notwithstanding any other provision of this section, an employer who complies with all provisions of this paragraph (g)(11) when installing, removing, repairing, or maintaining intact pipeline asphaltic wrap, or roof flashings which contain asbestos fibers encapsulated or coated by bituminous or resinous compounds shall be deemed to be in compliance with this section. If an employer does not comply with all provisions of this paragraph (g)(11) or if during the course of the job the material does not remain intact, the provisions of paragraph (g)(8) of this section apply instead of this paragraph (g)(11).

1926.1101(g)(11)(i)

Before work begins and as needed during the job, a competent person who is capable of identifying asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, and who has the authority to take prompt corrective measures to eliminate such hazards, shall conduct an inspection of the worksite and determine that the roofing material is intact and will likely remain intact.

1926.1101(g)(11)(ii)

All employees performing work covered by this paragraph (g)(11) shall be trained in a training program that meets the requirements of paragraph (k)(9)(viii) of this section.

1926.1101(g)(11)(iii)

The material shall not be sanded, abraded, or ground. Manual methods which do not render the material non-intact shall be used.

1926.1101(g)(11)(iv)

Material that has been removed from a roof shall not be dropped or thrown to the ground. Unless the material is carried or passed to the ground by hand, it shall be lowered to the ground via covered, dust-tight chute, crane or hoist. All such material shall be removed from the roof as soon as is practicable, but in any event no later than the end of the work shift.

1926.1101(g)(11)(v)

Where roofing products which have been labeled as containing asbestos pursuant to paragraph (k)(8) of this

section are installed on non-residential roofs during operations covered by this paragraph (g)(11), the employer shall notify the building owner of the presence and location of such materials no later than the end of the job.

1926.1101(g)(11)(vi)

All removal or disturbance of pipeline asphaltic wrap shall be performed using wet methods.

1926.1101(h)

Respiratory protection.

1926.1101(h)(1)

General. For employees who use respirators required by this section, the employer must provide each employee an appropriate respirator that complies with the requirements of this paragraph. Respirators must be used during:

1926.1101(h)(1)(i)

Class I asbestos work.

1926.1101(h)(1)(ii)

Class II asbestos work when ACM is not removed in a substantially intact state.

1926.1101(h)(1)(iii)

Class II and III asbestos work that is not performed using wet methods, except for removal of ACM from sloped roofs when a negative-exposure assessment has been conducted and ACM is removed in an intact state.

1926.1101(h)(1)(iv)

Class II and III asbestos work for which a negative-exposure assessment has not been conducted.

1926.1101(h)(v)

Class III asbestos work when TSI or surfacing ACM or PACM is being disturbed.

1926.1101(h)(1)(vi)

Class IV asbestos work performed within regulated areas where employees who are performing other work are required to use respirators.

1926.1101(h)(1)(vii)

Work operations covered by this section for which employees are exposed above the TWA or excursion limit.

1926.1101(h)(1)(viii)

Emergencies.

1926.1101(h)(2)

Respirator program.

1926.1101(h)(2)(i)

The employer must implement a respiratory protection program in accordance with § 1910.134 (b) through (d) (except (d)(1)(iii)), and (f) through (m), which covers each employee required by this section to use a respirator.

1926.1101(h)(2)(ii)

No employee shall be assigned to asbestos work that requires respirator use if, based on their most recent medical examination, the examining physician determines that the employee will be unable to function normally while using a respirator, or that the safety or health of the employee or other employees will be impaired by the employee's respirator use. Such employees must be assigned to another job or given the opportunity to transfer to a different position that they can perform. If such a transfer position is available, it must be with the same employer, in the same geographical area, and with the same seniority, status, rate of pay, and other job benefits the employee had just prior to such transfer.

1926.1101(h)(3)

Respirator selection.

1926.1101(h)(3)(i)

Employers must:

1926.1101(h)(3)(i)(A)

Select, and provide to employees, the appropriate respirators specified in paragraph (d)(3)(i)(A) of 29 CFR 1910.134; however, employers must not select or use filtering facepiece respirators for use against asbestos fibers.

1926.1101(h)(3)(i)(B)

Provide HEPA filters for powered and non-powered air-purifying respirators.

1926.1101(h)(3)(ii)

Employers must provide an employee with tight-fitting, powered air-purifying respirator (PAPR) instead of a negative pressure respirator selected according to paragraph (h)(3)(i)(A) of this standard when the employee chooses to use a PAPR and it provides adequate protection to the employee.

1926.1101(h)(3)(iii)

Employers must provide employees with an air-purifying half mask respirator, other than a filtering facepiece respirator, whenever the employees perform:

1926.1101(h)(3)(iii)(A)

Class II or Class III asbestos work for which no negative exposure assessment is available.

1926.1101(h)(3)(iii)(B)

Class III asbestos work involving disturbance of TSI or surfacing ACM or PACM.

[1926.1101\(h\)\(3\)\(iv\)](#)

Employers must provide employees with:

1926.1101(h)(3)(iv)(A)

A tight-fitting powered air-purifying respirator or a full facepiece, supplied-air respirator operated in the pressure-demand mode and equipped with either HEPA egress cartridges or an auxiliary positive-pressure, self-contained breathing apparatus (SCBA) whenever the employees are in a regulated area performing Class I asbestos work for which a negative exposure assessment is not available and the exposure assessment indicates that the exposure level will be at or below 1 f/cc as an 8-hour time-weighted average (TWA).

1926.1101(h)(3)(iv)(B)

A full facepiece supplied-air respirator operated in the pressure-demand mode and equipped with an auxiliary positive-pressure SCBA whenever the employees are in a regulated area performing Class I asbestos work for which a negative exposure assessment is not available and the exposure assessment indicates that the exposure level will be above 1 f/cc as an 8-hour TWA.

1926.1101(i)

Protective clothing.

1926.1101(i)(1)

General. The employer shall provide and require the use of protective clothing, such as coveralls or similar whole-body clothing, head coverings, gloves, and foot coverings for any employee exposed to airborne concentrations of asbestos that exceed the TWA and/or excursion limit prescribed in paragraph (c) of this section, or for which a required negative exposure assessment is not produced, or for any employee performing Class I operations which involve the removal of over 25 linear or 10 square feet of TSI or surfacing ACM and PACM.

1926.1101(i)(2)

Laundering.

1926.1101(i)(2)(i)

The employer shall ensure that laundering of contaminated clothing is done so as to prevent the release of airborne asbestos in excess of the TWA or excursion limit prescribed in paragraph (c) of this section.

1926.1101(i)(2)(ii)

Any employer who gives contaminated clothing to another person for laundering shall inform such person of the requirement in paragraph (i)(2)(i) of this section to effectively prevent the release of airborne asbestos in excess of the TWA and excursion limit prescribed in paragraph (c) of this section.

1926.1101(i)(3)

Contaminated clothing. Contaminated clothing shall be transported in sealed impermeable bags, or other closed, impermeable containers, and be labeled in accordance with paragraph (k) of this section.

1926.1101(i)(4)

Inspection of protective clothing.

1926.1101(i)(4)(i)

The competent person shall examine worksuits worn by employees at least once per workshift for rips or tears that may occur during performance of work.

1926.1101(i)(4)(ii)

When rips or tears are detected while an employee is working, rips and tears shall be immediately mended, or the worksuit shall be immediately replaced.

1926.1101(j)

Hygiene facilities and practices for employees.

1926.1101(j)(1)

Requirements for employees performing Class I asbestos jobs involving over 25 linear or 10 square feet of TSI or surfacing ACM and PACM.

1926.1101(j)(1)(i)

Decontamination areas. the employer shall establish a decontamination area that is adjacent and connected to the regulated area for the decontamination of such employees. The decontamination area shall consist of an equipment room, shower area, and clean room in series. The employer shall ensure that employees enter and exit the regulated area through the decontamination area.

1926.1101(j)(1)(i)(A)

Equipment room. The equipment room shall be supplied with impermeable, labeled bags and containers for the containment and disposal of contaminated protective equipment.

1926.1101(j)(1)(i)(B)

Shower area. Shower facilities shall be provided which comply with 29 CFR 1910.141(d)(3), unless the employer can demonstrate that they are not feasible. The showers shall be adjacent both to the equipment room and the clean room, unless the employer can demonstrate that this location is not feasible. Where the employer can demonstrate that it is not feasible to locate the shower between the equipment room and the clean room, or where the work is performed outdoors, the employers shall ensure that employees:

1926.1101(j)(1)(i)(B)(1)

Remove asbestos contamination from their worksuits in the equipment room using a HEPA vacuum before proceeding to a shower that is not adjacent to the work area; or

1926.1101(j)(1)(i)(B)(2)

Remove their contaminated worksuits in the equipment room, then don clean worksuits, and proceed to a shower that is not adjacent to the work area.

1926.1101(j)(1)(i)(C)

Clean change room. The clean room shall be equipped with a locker or appropriate storage container for each employee's use. When the employer can demonstrate that it is not feasible to provide a clean change area adjacent to the work area or where the work is performed outdoors, the employer may permit employees

engaged in Class I asbestos jobs to clean their protective clothing with a portable HEPA-equipped vacuum before such employees leave the regulated area. Following showering, such employees however must then change into street clothing in clean change areas provided by the employer which otherwise meet the requirements of this section.

1926.1101(j)(1)(ii)

Decontamination area entry procedures. The employer shall ensure that employees:

1926.1101(j)(1)(ii)(A)

Enter the decontamination area through the clean room;

1926.1101(j)(1)(ii)(B)

Remove and deposit street clothing within a locker provided for their use; and

1926.1101(j)(1)(ii)(C)

Put on protective clothing and respiratory protection before leaving the clean room.

1926.1101(j)(1)(ii)(D)

Before entering the regulated area, the employer shall ensure that employees pass through the equipment room.

1926.1101(j)(1)(iii)

Decontamination area exit procedures. The employer shall ensure that:

1926.1101(j)(1)(iii)(A)

Before leaving the regulated area, employees shall remove all gross contamination and debris from their protective clothing.

1926.1101(j)(1)(iii)(B)

Employees shall remove their protective clothing in the equipment room and deposit the clothing in labeled impermeable bags or containers.

1926.1101(j)(1)(iii)(C)

Employees shall not remove their respirators in the equipment room.

1926.1101(j)(1)(iii)(D)

Employees shall shower prior to entering the clean room.

1926.1101(j)(1)(iii)(E)

After showering, employees shall enter the clean room before changing into street clothes.

1926.1101(j)(1)(iv)

Lunch Areas. Whenever food or beverages are consumed at the worksite where employees are performing Class I

asbestos work, the employer shall provide lunch areas in which the airborne concentrations of asbestos are below the permissible exposure limit and/or excursion limit.

1926.1101(j)(2)

Requirements for Class I work involving less than 25 linear or 10 square feet of TSI or surfacing ACM and PACM, and for Class II and Class III asbestos work operations where exposures exceed a PEL or where there is no negative exposure assessment produced before the operation.

1926.1101(j)(2)(i)

The employer shall establish an equipment room or area that is adjacent to the regulated area for the decontamination of employees and their equipment which is contaminated with asbestos which shall consist of an area covered by a impermeable drop cloth on the floor or horizontal working surface.

1926.1101(j)(2)(ii)

The area must be of sufficient size as to accommodate cleaning of equipment and removing personal protective equipment without spreading contamination beyond the area (as determined by visible accumulations).

1926.1101(j)(2)(iii)

Work clothing must be cleaned with a HEPA vacuum before it is removed.

1926.1101(j)(2)(iv)

All equipment and surfaces of containers filled with ACM must be cleaned prior to removing them from the equipment room or area.

1926.1101(j)(2)(v)

The employer shall ensure that employees enter and exit the regulated area through the equipment room or area.

1926.1101(j)(3)

Requirements for Class IV work. Employers shall ensure that employees performing Class IV work within a regulated area comply with the hygiene practice required of employees performing work which has a higher classification within that regulated area. Otherwise employers of employees cleaning up debris and material which is TSI or surfacing ACM or identified as PACM shall provide decontamination facilities for such employees which are required by paragraph (j)(2) of this section.

[1926.1101\(j\)\(4\)](#)

Smoking in work areas. The employer shall ensure that employees do not smoke in work areas where they are occupationally exposed to asbestos because of activities in that work area.

[1926.1101\(k\)](#)

Communication of hazards.

[1926.1101\(k\)\(1\)](#)

This section applies to the communication of information concerning asbestos hazards in construction activities to facilitate compliance with this standard. Most asbestos-related construction activities involve previously installed

building materials. Building owners often are the only and/or best sources of information concerning them. Therefore, they, along with employers of potentially exposed employees, are assigned specific information conveying and retention duties under this section. Installed Asbestos Containing Building Material. Employers and building owners shall identify TSI and sprayed or troweled on surfacing materials in buildings as asbestos-containing, unless they determine in compliance with paragraph (k)(5) of this section that the material is not asbestos-containing. Asphalt and vinyl flooring material installed no later than 1980 must also be considered as asbestos containing unless the employer, pursuant to paragraph (g)(8)(i)(I) of this section determines that it is not asbestos-containing. If the employer/building owner has actual knowledge, or should have known through the exercise of due diligence, that other materials are asbestos-containing, they too must be treated as such. When communicating information to employees pursuant to this standard, owners and employers shall identify "PACM" as ACM. Additional requirements relating to communication of asbestos work on multi-employer worksites are set out in paragraph (d) of this section.

[1926.1101\(k\)\(2\)](#)

Duties of building and facility owners.

1926.1101(k)(2)(i)

Before work subject to this standard is begun, building and facility owners shall determine the presence, location, and quantity of ACM and/or PACM at the work site pursuant to paragraph (k)(1) of this section.

1926.1101(k)(2)(ii)

Building and/or facility owners shall notify the following persons of the presence, location and quantity of ACM or PACM, at the work sites in their buildings and facilities. Notification either shall be in writing, or shall consist of a personal communication between the owner and the person to whom notification must be given or their authorized representatives:

1926.1101(k)(2)(ii)(A)

Prospective employers applying or bidding for work whose employees reasonably can be expected to work in or adjacent to areas containing such material;

1926.1101(k)(2)(ii)(B)

Employees of the owner who will work in or adjacent to areas containing such material:

1926.1101(k)(2)(ii)(C)

On multi-employer worksites, all employers of employees who will be performing work within or adjacent to areas containing such materials;

1926.1101(k)(2)(ii)(D)

Tenants who will occupy areas containing such material.

[1926.1101\(k\)\(3\)](#)

Duties of employers whose employees perform work subject to this standard in or adjacent to areas containing ACM and PACM. Building/facility owners whose employees perform such work shall comply with these provisions to the extent applicable.

1926.1101(k)(3)(i)

Before work in areas containing ACM and PACM is begun; employers shall identify the presence, location, and quantity of ACM, and/or PACM therein pursuant to paragraph (k)(1) of this section.

1926.1101(k)(3)(ii)

Before work under this standard is performed employers of employees who will perform such work shall inform the following persons of the location and quantity of ACM and/or PACM present in the area and the precautions to be taken to insure that airborne asbestos is confined to the area.

1926.1101(k)(3)(ii)(A)

Owners of the building/facility;

1926.1101(k)(3)(ii)(B)

Employees who will perform such work and employers of employees who work and/or will be working in adjacent areas.

1926.1101(k)(3)(iii)

Within 10 days of the completion of such work, the employer whose employees have performed work subject to this standard, shall inform the building/facility owner and employers of employees who will be working in the area of the current location and quantity of PACM and/or ACM remaining in the area and final monitoring results, if any.

1926.1101(k)(4)

In addition to the above requirements, all employers who discover ACM and/or PACM on a worksite shall convey information concerning the presence, location and quantity of such newly discovered ACM and/or PACM to the owner and to other employers of employees working at the work site, within 24 hours of the discovery.

1926.1101(k)(5)

Criteria to rebut the designation of installed material as PACM.

1926.1101(k)(5)(i)

At any time, an employer and/or building owner may demonstrate, for purposes of this standard, that PACM does not contain asbestos. Building owners and/or employers are not required to communicate information about the presence of building material for which such a demonstration pursuant to the requirements of paragraph (k)(5)(ii) of this section has been made. However, in all such cases, the information, data and analysis supporting the determination that PACM does not contain asbestos, shall be retained pursuant to paragraph (n) of this section.

1926.1101(k)(5)(ii)

An employer or owner may demonstrate that PACM does not contain more than 1 percent asbestos by the following:

1926.1101(k)(5)(ii)(A)

Having a completed inspection conducted pursuant to the requirements of AHERA (40 CFR Part 763, Subpart E)

which demonstrates that the material is not ACM; or

[1926.1101\(k\)\(5\)\(ii\)\(B\)](#)

Performing tests of the material containing PACM which demonstrate that no ACM is present in the material. Such tests shall include analysis of bulk samples collected in the manner described in 40 CFR 763.86. The tests, evaluation and sample collection shall be conducted by an accredited inspector or by a CIH. Analysis of samples shall be performed by persons or laboratories with proficiency demonstrated by current successful participation in a nationally recognized testing program such as the National Voluntary Laboratory Accreditation Program (NVLAP) or the National Institute for Standards and Technology (NIST) or the Round Robin for bulk samples administered by the American Industrial Hygiene Association (AIHA) or an equivalent nationally-recognized round robin testing program.

1926.1101(k)(5)(iii)

The employer and/or building owner may demonstrate that flooring material including associated mastic and backing does not contain asbestos, by a determination of an industrial hygienist based upon recognized analytical techniques showing that the material is not ACM.

1926.1101(k)(6)

At the entrance to mechanical rooms/areas in which employees reasonably can be expected to enter and which contain ACM and/or PACM, the building owner shall post signs which identify the material which is present, its location, and appropriate work practices which, if followed, will ensure that ACM and/or PACM will not be disturbed. The employer shall ensure, to the extent feasible, that employees who come in contact with these signs can comprehend them. Means to ensure employee comprehension may include the use of foreign languages, pictographs, graphics, and awareness training.

[1926.1101\(k\)\(7\)](#)

Signs.

1926.1101(k)(7)(i)

Warning signs that demarcate the regulated area shall be provided and displayed at each location where a regulated area is required to be established by paragraph (e) of this section. Signs shall be posted at such a distance from such a location that an employee may read the signs and take necessary protective steps before entering the area marked by the signs.

1926.1101(k)(7)(ii)(A)

The warning signs required by paragraph (k)(7) of this section shall bear the following information.

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY

1926.1101(k)(7)(ii)(B)

In addition, where the use of respirators and protective clothing is required in the regulated area under this section, the warning signs shall include the following:

RESPIRATORS AND PROTECTION CLOTHING ARE REQUIRED IN THIS AREA

1926.1101(k)(7)(iii)

The employer shall ensure that employees working in and contiguous to regulated areas comprehend the warning signs required to be posted by paragraph (k)(7)(i) of this section. Means to ensure employee comprehension may include the use of foreign languages, pictographs and graphics.

[1926.1101\(k\)\(8\)](#)

Labels.

[1926.1101\(k\)\(8\)\(i\)](#)

Labels shall be affixed to all products containing asbestos and to all containers containing such products, including waste containers. Where feasible, installed asbestos products shall contain a visible label.

1926.1101(k)(8)(ii)

Labels shall be printed in large, bold letters on a contrasting background.

[1926.1101\(k\)\(8\)\(iii\)](#)

Labels shall be used in accordance with the requirements of 29 CFR 1910.1200(f) of OSHA's Hazard Communication standard, and shall contain the following information:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

1926.1101(k)(8)(iv)

[Reserved]

1926.1101(k)(8)(v)

Labels shall contain a warning statement against breathing asbestos fibers.

1926.1101(k)(8)(vi)

The provisions for labels required by paragraphs (k)(8)(i) through (k)(8)(iii) of this section do not apply where:

[1926.1101\(k\)\(8\)\(vi\)\(A\)](#)

Asbestos fibers have been modified by a bonding agent, coating, binder, or other material, provided that the manufacturer can demonstrate that, during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of asbestos fibers in excess of the permissible exposure limit and/or excursion limit will be released, or

1926.1101(k)(8)(vi)(B)

Asbestos is present in a product in concentrations less than 1.0 percent.

1926.1101(k)(8)(vii)

When a building owner or employer identifies previously installed PACM and/or ACM, labels or signs shall be affixed or posted so that employees will be notified of what materials contain PACM and/or ACM. The employer shall attach such labels in areas where they will clearly be noticed by employees who are likely to be exposed, such as at the entrance to mechanical room/areas. Signs required by paragraph (k)(6) of this section may be posted in lieu of labels so long as they contain information required for labelling. The employer shall ensure, to the extent feasible, that employees who come in contact with these signs or labels can comprehend them. Means to ensure employee comprehension may include the use of foreign languages, pictographs, graphics, and awareness training.

[1926.1101\(k\)\(9\)](#)

Employee Information and Training.

1926.1101(k)(9)(i)

The employer shall train each employee who is likely to be exposed in excess of a PEL, and each employee who performs Class I through IV asbestos operations, in accordance with the requirements of this section. Such training shall be conducted at no cost to the employee. The employer shall institute a training program and ensure employee participation in the program.

1926.1101(k)(9)(ii)

Training shall be provided prior to or at the time of initial assignment and at least annually thereafter.

1926.1101(k)(9)(iii)

Training for Class I operations and for Class II operations that require the use of critical barriers (or equivalent isolation methods) and/or negative pressure enclosures under this section shall be the equivalent in curriculum, training method and length to the EPA Model Accreditation Plan (MAP) asbestos abatement workers training (40 CFR Part 763, subpart E, appendix C).

1926.1101(k)(9)(iv)

Training for other Class II work.

1926.1101(k)(9)(iv)(A)

For work with asbestos containing roofing materials, flooring materials, siding materials, ceiling tiles, or transite panels, training shall include at a minimum all the elements included in paragraph (k)(9)(viii) of this section and in addition, the specific work practices and engineering controls set forth in paragraph (g) of this section which specifically relate to that category. Such course shall include "hands-on" training and shall take at least 8 hours.

1926.1101(k)(9)(iv)(B)

An employee who works with more than one of the categories of material specified in paragraph (k)(9)(iv)(A) of this section shall receive training in the work practices applicable to each category of material that the employee removes and each removal method that the employee uses.

1926.1101(k)(9)(iv)(C)

For Class II operations not involving the categories of material specified in paragraph (k)(9)(iv)(A) of this section, training shall be provided which shall include at a minimum all the elements included in paragraph (k)(9)(viii) of this section and in addition, the specific work practices and engineering controls set forth in paragraph (g) of this section which specifically relate to the category of material being removed, and shall include "hands-on" training in the work practices applicable to each category of material that the employee removes and each removal method that the employee uses.

1926.1101(k)(9)(v)

Training for Class III employees shall be consistent with EPA requirements for training of local education agency maintenance and custodial staff as set forth at 40 CFR 763.92(a)(2). Such a course shall also include "hands-on" training and shall take at least 16 hours. Exception: For Class III operations for which the competent person determines that the EPA curriculum does not adequately cover the training needed to perform that activity, training shall include as a minimum all the elements included in paragraph (k)(9)(viii) of this section and in addition, the specific work practices and engineering controls set forth in paragraph (g) of this section which specifically relate to that activity, and shall include "hands-on" training in the work practices applicable to each category of material that the employee disturbs.

1926.1101(k)(9)(vi)

Training for employees performing Class IV operations shall be consistent with EPA requirements for training of local education agency maintenance and custodial staff as set forth at 40 CFR 763.92(a)(1). Such a course shall include available information concerning the locations of thermal system insulation and surfacing ACM/PACM, and asbestos-containing flooring material, or flooring material where the absence of asbestos has not yet been certified; and instruction in recognition of damage, deterioration, and delamination of asbestos containing building materials. Such course shall take at least 2 hours.

1926.1101(k)(9)(vii)

Training for employees who are likely to be exposed in excess of the PEL and who are not otherwise required to be trained under paragraph (k)(9)(iii) through (vi) of this section, shall meet the requirements of paragraph (k)(9)(viii) of this section.

1926.1101(k)(9)(viii)

The training program shall be conducted in a manner that the employee is able to understand. In addition to the content required by provisions in paragraphs (k)(9)(iii) through (vi) of this section, the employer shall ensure that each such employee is informed of the following:

1926.1101(k)(9)(viii)(A)

Methods of recognizing asbestos, including the requirement in paragraph (k)(1) of this section to presume that certain building materials contain asbestos;

1926.1101(k)(9)(viii)(B)

The health effects associated with asbestos exposure;

1926.1101(k)(9)(viii)(C)

The relationship between smoking and asbestos in producing lung cancer;

1926.1101(k)(9)(viii)(D)

The nature of operations that could result in exposure to asbestos, the importance of necessary protective

controls to minimize exposure including, as applicable, engineering controls, work practices, respirators, housekeeping procedures, hygiene facilities, protective clothing, decontamination procedures, emergency procedures, and waste disposal procedures, and any necessary instruction in the use of these controls and procedures; where Class III and IV work will be or is performed, the contents of EPA 20T-2003, "Managing Asbestos In-Place" July 1990 or its equivalent in content;

1926.1101(k)(9)(viii)(E)

The purpose, proper use, fitting instructions, and limitations of respirators as required by 29 CFR 1910.134;

1926.1101(k)(9)(viii)(F)

The appropriate work practices for performing the asbestos job;

1926.1101(k)(9)(viii)(G)

Medical surveillance program requirements;

1926.1101(k)(9)(viii)(H)

The content of this standard including appendices;

1926.1101(k)(9)(viii)(I)

The names, addresses and phone numbers of public health organizations which provide information, materials and/or conduct programs concerning smoking cessation. The employer may distribute the list of such organizations contained in Appendix J to this section, to comply with this requirement; and

1926.1101(k)(9)(viii)(J)

The requirements for posting signs and affixing labels and the meaning of the required legends for such signs and labels.

1926.1101(k)(10)

Access to training materials.

1926.1101(k)(10)(i)

The employer shall make readily available to affected employees without cost, written materials relating to the employee training program, including a copy of this regulation.

1926.1101(k)(10)(ii)

The employer shall provide to the Assistant Secretary and the Director, upon request, all information and training materials relating to the employee information and training program.

1926.1101(k)(10)(iii)

The employer shall inform all employees concerning the availability of self-help smoking cessation program material. Upon employee request, the employer shall distribute such material, consisting of NIH Publication No, 89-1647, or equivalent self-help material, which is approved or published by a public health organization listed in Appendix J to this section.

1926.1101(l)

Housekeeping --

[1926.1101\(l\)\(1\)](#)

Vacuuming. Where vacuuming methods are selected, HEPA filtered vacuuming equipment must be used. The equipment shall be used and emptied in a manner that minimizes the reentry of asbestos into the workplace.

[1926.1101\(l\)\(2\)](#)

Waste disposal. Asbestos waste, scrap, debris, bags, containers, equipment, and contaminated clothing consigned for disposal shall be collected and disposed of in sealed, labeled, impermeable bags or other closed, labeled, impermeable containers except in roofing operations where the procedures specified in paragraph (g)(8)(ii) of this section apply.

[1926.1101\(l\)\(3\)](#)

Care of asbestos-containing flooring material.

1926.1101(l)(3)(i)

All vinyl and asphalt flooring material shall be maintained in accordance with this paragraph unless the building/facility owner demonstrates, pursuant to paragraph (g)(8)(i)(I) of this section that the flooring does not contain asbestos.

1926.1101(l)(3)(ii)

Sanding of flooring material is prohibited.

1926.1101(l)(3)(iii)

Stripping of finishes shall be conducted using low abrasion pads at speeds lower than 300 rpm and wet methods.

1926.1101(l)(3)(iv)

Burnishing or dry buffing may be performed only on flooring which has sufficient finish so that the pad cannot contact the flooring material.

1926.1101(l)(4)

Waste and debris and accompanying dust in an area containing accessible thermal system insulation or surfacing ACM/PACM or visibly deteriorated ACM:

1926.1101(l)(4)(i)

shall not be dusted or swept dry, or vacuumed without using a HEPA filter;

1926.1101(l)(4)(ii)

shall be promptly cleaned up and disposed of in leak tight containers.

[1926.1101\(m\)](#)

Medical surveillance.

1926.1101(m)(1)

General --

1926.1101(m)(1)(i)

Employees covered.

1926.1101(m)(1)(i)(A)

The employer shall institute a medical surveillance program for all employees who for a combined total of 30 or more days per year are engaged in Class I, II and III work or are exposed at or above a permissible exposure limit. For purposes of this paragraph, any day in which a worker engages in Class II or Class III operations or a combination thereof on intact material for one hour or less (taking into account the entire time spent on the removal operation, including cleanup) and, while doing so, adheres fully to the work practices specified in this standard, shall not be counted.

1926.1101(m)(1)(i)(B)

For employees otherwise required by this standard to wear a negative pressure respirator, employers shall ensure employees are physically able to perform the work and use the equipment. This determination shall be made under the supervision of a physician.

1926.1101(m)(1)(ii)

Examination.

1926.1101(m)(1)(ii)(A)

The employer shall ensure that all medical examinations and procedures are performed by or under the supervision of a licensed physician, and are provided at no cost to the employee and at a reasonable time and place.

1926.1101(m)(1)(ii)(B)

Persons other than such licensed physicians who administer the pulmonary function testing required by this section shall complete a training course in spirometry sponsored by an appropriate academic or professional institution.

1926.1101(m)(2)

Medical examinations and consultations.

1926.1101(m)(2)(i)

Frequency. The employer shall make available medical examinations and consultations to each employee covered under paragraph (m)(1)(i) of this section on the following schedules:

1926.1101(m)(2)(i)(A)

Prior to assignment of the employee to an area where negative-pressure respirators are worn;

1926.1101(m)(2)(i)(B)

When the employee is assigned to an area where exposure to asbestos may be at or above the permissible exposure limit for 30 or more days per year, or engage in Class I, II, or III work for a combined total of 30 or more days per year, a medical examination must be given within 10 working days following the thirtieth day of exposure;

1926.1101(m)(2)(i)(C)

And at least annually thereafter.

1926.1101(m)(2)(i)(D)

If the examining physician determines that any of the examinations should be provided more frequently than specified, the employer shall provide such examinations to affected employees at the frequencies specified by the physician.

1926.1101(m)(2)(i)(E)

Exception: No medical examination is required of any employee if adequate records show that the employee has been examined in accordance with this paragraph within the past 1-year period.

1926.1101(m)(2)(ii)

Content. Medical examinations made available pursuant to paragraphs (m)(2)(i)(A) through (m)(2)(i)(C) of this section shall include:

1926.1101(m)(2)(ii)(A)

A medical and work history with special emphasis directed to the pulmonary, cardiovascular, and gastrointestinal systems.

1926.1101(m)(2)(ii)(B)

On initial examination, the standardized questionnaire contained in Part 1 of Appendix D to this section, and, on annual examination, the abbreviated standardized questionnaire contained in Part 2 of Appendix D to this section.

1926.1101(m)(2)(ii)(C)

A physical examination directed to the pulmonary and gastrointestinal systems, including a chest roentgenogram to be administered at the discretion of the physician, and pulmonary function tests of forced vital capacity (FVC) and forced expiratory volume at one second (FEV(1)). Interpretation and classification of chest shall be conducted in accordance with Appendix E to this section.

1926.1101(m)(2)(ii)(D)

Any other examinations or tests deemed necessary by the examining physician.

1926.1101(m)(3)

Information provided to the physician. The employer shall provide the following information to the examining physician:

1926.1101(m)(3)(i)

A copy of this standard and Appendices D, E, and I to this section;

1926.1101(m)(3)(ii)

A description of the affected employee's duties as they relate to the employee's exposure;

1926.1101(m)(3)(iii)

The employee's representative exposure level or anticipated exposure level;

1926.1101(m)(3)(iv)

A description of any personal protective and respiratory equipment used or to be used; and

1926.1101(m)(3)(v)

Information from previous medical examinations of the affected employee that is not otherwise available to the examining physician.

[1926.1101\(m\)\(4\)](#)

Physician's written opinion.

[1926.1101\(m\)\(4\)\(i\)](#)

The employer shall obtain a written opinion from the examining physician. This written opinion shall contain the results of the medical examination and shall include:

1926.1101(m)(4)(i)(A)

The physician's opinion as to whether the employee has any detected medical conditions that would place the employee at an increased risk of material health impairment from exposure to asbestos;

1926.1101(m)(4)(i)(B)

Any recommended limitations on the employee or on the use of personal protective equipment such as respirators; and

1926.1101(m)(4)(i)(C)

A statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions that may result from asbestos exposure.

1926.1101(m)(4)(i)(D)

A statement that the employee has been informed by the physician of the increased risk of lung cancer attributable to the combined effect of smoking and asbestos exposure.

1926.1101(m)(4)(ii)

The employer shall instruct the physician not to reveal in the written opinion given to the employer specific

findings or diagnoses unrelated to occupational exposure to asbestos.

1926.1101(m)(4)(iii)

The employer shall provide a copy of the physician's written opinion to the affected employee within 30 days from its receipt.

[1926.1101\(n\)](#)

Recordkeeping.

1926.1101(n)(1)

Objective data relied on pursuant to paragraph (f) to this section.

1926.1101(n)(1)(i)

Where the employer has relied on objective data that demonstrates that products made from or containing asbestos or the activity involving such products or material are not capable of releasing fibers of asbestos in concentrations at or above the permissible exposure limit and/or excursion limit under the expected conditions of processing, use, or handling to satisfy the requirements of paragraph (f), the employer shall establish and maintain an accurate record of objective data reasonably relied upon in support of the exemption.

1926.1101(n)(1)(ii)

The record shall include at least the following information:

1926.1101(n)(1)(ii)(A)

The product qualifying for exemption;

1926.1101(n)(1)(ii)(B)

The source of the objective data;

1926.1101(n)(1)(ii)(C)

The testing protocol, results of testing, and/or analysis of the material for the release of asbestos;

1926.1101(n)(1)(ii)(D)

A description of the operation exempted and how the data support the exemption; and

1926.1101(n)(1)(ii)(E)

Other data relevant to the operations, materials, processing, or employee exposures covered by the exemption.

1926.1101(n)(1)(iii)

The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

[1926.1101\(n\)\(2\)](#)

Exposure measurements.

1926.1101(n)(2)(i)

The employer shall keep an accurate record of all measurements taken to monitor employee exposure to asbestos as prescribed in paragraph (f) of this section. NOTE: The employer may utilize the services of competent organizations such as industry trade associations and employee associations to maintain the records required by this section.

1926.1101(n)(2)(ii)

This record shall include at least the following information:

1926.1101(n)(2)(ii)(A)

The date of measurement;

1926.1101(n)(2)(ii)(B)

The operation involving exposure to asbestos that is being monitored;

1926.1101(n)(2)(ii)(C)

Sampling and analytical methods used and evidence of their accuracy;

1926.1101(n)(2)(ii)(D)

Number, duration, and results of samples taken;

1926.1101(n)(2)(ii)(E)

Type of protective devices worn, if any; and

[1926.1101\(n\)\(2\)\(ii\)\(F\)](#)

Name, social security number, and exposure of the employees whose exposures are represented.

1926.1101(n)(2)(iii)

The employer shall maintain this record for at least thirty (30) years, in accordance with 29 CFR 1910.20.

1926.1101(n)(3)

Medical surveillance.

1926.1101(n)(3)(i)

The employer shall establish and maintain an accurate record for each employee subject to medical surveillance by paragraph (m) of this section, in accordance with 29 CFR 1910.20.

1926.1101(n)(3)(ii)

The record shall include at least the following information:

1926.1101(n)(3)(ii)(A)

The name and social security number of the employee;

1926.1101(n)(3)(ii)(B)

A copy of the employee's medical examination results, including the medical history, questionnaire responses, results of any tests, and physician's recommendations.

1926.1101(n)(3)(ii)(C)

Physician's written opinions;

1926.1101(n)(3)(ii)(D)

Any employee medical complaints related to exposure to asbestos; and

1926.1101(n)(3)(ii)(E)

A copy of the information provided to the physician as required by paragraph (m) of this section.

1926.1101(n)(3)(iii)

The employer shall ensure that this record is maintained for the duration of employment plus thirty (30) years, in accordance with 29 CFR 1910.20.

1926.1101(n)(4)

Training records. The employer shall maintain all employee training records for one (1) year beyond the last date of employment by that employer.

1926.1101(n)(5)

Data to Rebut PACM. Where the building owner and employer have relied on data to demonstrate that PACM is not asbestos-containing, such data shall be maintained for as long as they are relied upon to rebut the presumption.

1926.1101(n)(6)

Records of Required Notifications. Where the building owner has communicated and received information concerning the identification, location and quantity of ACM and PACM, written records of such notifications and their content shall be maintained by the building owner for the duration of ownership and shall be transferred to successive owners of such buildings/facilities.

1926.1101(n)(7)

Availability.

1926.1101(n)(7)(i)

The employer, upon written request, shall make all records required to be maintained by this section available to the Assistant Secretary and the Director for examination and copying.

1926.1101(n)(7)(ii)

The employer must comply with the requirements concerning availability of records set forth in 29 CFR 1910.1020.

1926.1101(n)(8)

Transfer of records. The employer must comply with the requirements concerning transfer of records set forth in 29 CFR 1910.1020(h).

1926.1101(o)

Competent person.

1926.1101(o)(1)

General. On all construction worksites covered by this standard, the employer shall designate a competent person, having the qualifications and authorities for ensuring worker safety and health required by Subpart C, General Safety and Health Provisions for Construction (29 CFR 1926.20 through 1926.32).

1926.1101(o)(2)

Required Inspections by the Competent Person. Section 1926.20(b)(2) which requires health and safety prevention programs to provide for frequent and regular inspections of the job sites, materials, and equipment to be made by competent persons, is incorporated.

1926.1101(o)(3)

Additional Inspections. In addition, the competent person shall make frequent and regular inspections of the job sites, in order to perform the duties set out below in paragraph (o)(3)(i) and (ii) of this section. For Class I jobs, on-site inspections shall be made at least once during each work shift, and at any time at employee request. For Class II, III, and IV jobs, on-site inspections shall be made at intervals sufficient to assess whether conditions have changed, and at any reasonable time at employee request.

[1926.1101\(o\)\(3\)\(i\)](#)

On all worksites where employees are engaged in Class I or II asbestos work, the competent person designated in accordance with paragraph (e)(6) of this section shall perform or supervise the following duties, as applicable:

1926.1101(o)(3)(i)(A)

Set up the regulated area, enclosure, or other containment;

1926.1101(o)(3)(i)(B)

Ensure (by on-site inspection) the integrity of the enclosure or containment;

1926.1101(o)(3)(i)(C)

Set up procedures to control entry to and exit from the enclosure and/or area;

1926.1101(o)(3)(i)(D)

Supervise all employee exposure monitoring required by this section and ensure that it is conducted as required

by paragraph (f) of this section;

1926.1101(o)(3)(i)(E)

Ensure that employees working within the enclosure and/or using glove bags wear respirators and protective clothing as required by paragraphs (h) and (i) of this section;

1926.1101(o)(3)(i)(F)

Ensure through on-site supervision, that employees set up, use and remove engineering controls, use work practices and personal protective equipment in compliance with all requirements;

1926.1101(o)(3)(i)(G)

Ensure that employees use the hygiene facilities and observe the decontamination procedures specified in paragraph (j) of this section;

1926.1101(o)(3)(i)(H)

Ensure that through on-site inspection, engineering controls are functioning properly and employees are using proper work practices; and,

1926.1101(o)(3)(i)(I)

Ensure that notification requirement in paragraph (k) of this section are met.

1926.1101(o)(3)(ii)

[Reserved]

[1926.1101\(o\)\(4\)](#)

Training for the competent person.

1926.1101(o)(4)(i)

For Class I and II asbestos work the competent person shall be trained in all aspects of asbestos removal and handling, including: abatement, installation, removal and handling; the contents of this standard; the identification of asbestos; removal procedures, where appropriate; and other practices for reducing the hazard. Such training shall be obtained in a comprehensive course for supervisors that meets the criteria of EPA's Model Accredited Plan (40 CFR part 763, subpart E, Appendix C), such as a course conducted by an EPA-approved or state-approved training provider, certified by EPA or a state, or a course equivalent in stringency, content, and length.

1926.1101(o)(4)(ii)

For Class III and IV asbestos work, the competent person shall be trained in aspects of asbestos handling appropriate for the nature of the work, to include procedures for setting up glove bags and mini-enclosures, practices for reducing asbestos exposures, use of wet methods, the contents of this standard, and the identification of asbestos. Such training shall include successful completion of a course that is consistent with EPA requirements for training of local education agency maintenance and custodial staff as set forth at 40 CFR 763.92(a)(2), or its equivalent in stringency, content, and length. Competent persons for Class III and IV work, may also be trained pursuant to the requirements of paragraph (o)(4)(i) of this section.

1926.1101(p)

Appendices.

1926.1101(p)(1)

Appendices A, C, D, and E to this section are incorporated as part of this section and the contents of these appendices are mandatory.

1926.1101(p)(2)

Appendices B, F, H, I, J, and K to this section are informational and are not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

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